PROCEEDINGS

OF

THE ROYAL SOCIETY.

1843. No. 57.

March 30, 1843.

GEORGE RENNIE, Esq., V.P., in the Chair.

Joseph Miller, Esq. was balloted for and duly elected a Fellow of the Society.

The following papers were read, viz.—

1. "Researches into the Structure and Developement of a newly discovered parasitic Animalcule of the Human Skin, the *Entozoon folliculorum*." By Erasmus Wilson, Esq., Lecturer on Anatomy and Physiology at the Middlesex Hospital. Communicated by R. B. Todd, M.D., F.R.S.

While engaged in researches on the minute anatomy of the skin and its subsidiary organs, and particularly on the microscopical composition of the sebaceous substance, the author learned that Dr. Gustow Simon of Berlin had discovered an animalcule which inhabits the hair follicles of the human integument, and of which a description was published in a memoir contained in the first Number of Müller's Archiv for 1842. Of this memoir the author gives a translation at full length. He then states that, after careful search, he at length succeeded in finding the parasitic animals in question, and proceeded to investigate more fully and minutely than Dr. Simon had done the details of their structure, and the circumstances of their origin and developement. They exist in the sebaceous follicles of almost every individual, but are found more especially in those persons who possess a torpid skin; they increase in number during sickness, so as in general to be met with in great abundance after death. In living and healthy persons, from one to three or four of these entozoa are contained in each follicle. They are more numerous in the follicles situated in the depression by the side of the nose; but they are also found in those of the breast and abdomen, and on the back and loins. Their form changes in the progress of their growth. The perfect animal presents an elongated body, divisible into a head, thorax, and abdomen. From the front of the head proceed two moveable arms, apparently formed for prehension: and to the under side of the thorax are attached four pairs of legs, terminated by claws. The author distinguishes two principal varieties of the adult animal; the one remarkable for the great length of the abdomen and roundness of the caudal extremity; whilst the other is characterized by greater compactness of form, a shorter abdomen, and more pointed tail. The first variety was found to measure, in length, from the one-100th to the 45th, and the second, from the one-160th to the 109th part of an inch.

The author gives a minute description of the ova of these entozoa, which he follows in the successive stages of their developement. The paper is accompanied by numerous drawings of the objects described.

2. "On Factorial Expressions, and the Summation of Algebraic Series." By W. Tate, Esq. Communicated by the Rev. Henry Moseley, M.A., F.R.S., &c.

This paper, which is wholly analytical, contains an investigation of certain general methods for the summation of algebraic series, which have led the author to the discovery of some curious and elegant propositions relative to factorials and the decomposition of fractions; and also to a new demonstration of Taylor's theorem.

3. "Notice of the Comet;" in a Letter from Captain John Grover, F.R.S., addressed to P. M. Roget, M.D., Sec. R.S., and dated from Pisa, March 21st, 1843.

The author states that at Pisa, on Friday, the 17th of March, 1843, at eight o'clock in the evening, he saw a luminous arc in the heavens, extending from a spot about a degree to the south of Rigel to some clouds which bounded the western horizon. It was about 40 minutes in width; the edges sharply and clearly defined. On the 20th of March, the author could distinctly trace the extremity of the luminous streak, which he concluded was the tail of a comet, below the lower part of the constellation Orion, and reaching to the star η Eridani; while the stars δ and ϵ Eridani were distinctly seen with the naked eye through the coma. From η Eridani, it extended 47° 30′ to a spot nearly equidistant from χ Orionis and η Leporis.

4. "Variation de la Déclinaison et Intensité Horizontales Magnétiques observées à Milan pendant vingt-quatre heures consécutives le 18 et 19 Janvier, et le 20 et 25 Fevrier 1843." Par C. Carlini, For. Mem. R.S.

5. A paper was also in part read, entitled "On the general and minute Structure of the Spleen in Man and other Animals." By William Julian Evans, M.D. Communicated by P. M. Roget, M.D., Sec. R.S.

April 6, 1843.

FRANCIS BAILY, Esq., V.P., in the Chair.

Henry Wollaston Blake, Esq., and James Heygate, M.D., were balloted for and duly elected Fellows of the Society.

The following papers were read, viz.—

1. "On the general and minute Structure of the Spleen in Man and other Animals." By William Julian Evans, M.D. Communicated by P. M. Roget, M.D., Sec. R.S.

After adverting briefly to the discordant opinions of Malpighi, Ruysch, and others regarding the structure of the spleen, the author proceeds to detail the results of the investigations on this subject, in which he has been for many years engaged. According to his analysis, the following are the component parts of this organ:—first, a reticulated fibro-elastic tissue; secondly, a pulpy parenchyma, containing the Malpighian glands and the splenic corpuscles; thirdly, distinct cellular bodies; fourthly, the usual apparatus of arteries, veins, lymphatics and nerves; fifthly, certain fluids; and lastly, the membranes or tunics by which it is invested.

He describes the cells of the spleen as being formed of a lining membrane, continued from that of the splenic vein, and strengthened by filaments of the fibro-elastic tissue. The splenic vein communicates with these cells, at first by round foramina, then by extensive slits resembling lacerations; and it ultimately loses itself entirely in the cells. The cells themselves communicate freely with one another, and also with the veins of the parenchyma; and may therefore be considered as in some measure continuations of the veins. This structure constitutes a multilocular reservoir of great extensibility, and possessing great elastic contractility; properties, however, which exist in a much less degree in the human spleen than in that of herbivorous animals; in which animals the cellated structure itself is much more conspicuous, and predominates over the parenchymatous portion. As the splenic artery has no immediate communication with the cells, these latter may be filled much more readily by injection from the vein than from the artery. In the ordinary state of the circulation, the blood, which has passed into the cells from the veins, is pressed into the branches of the splenic veins by a force derived from the elasticity of the fibro-elastic tissue which surrounds the cavities of the cells, thus constituting a *vis-a-tergo*, which contributes to propel the blood onwards in its circulation through the liver. Should there arise, however, any obstructing cause which the resilience of the spleen is unable to overcome, a regurgitation must take place, leading to a congestion both in the mesenteric and splenic veins. The spleen may thus serve as a receptacle for the blood of the abdominal circulation during any temporary check to its free passage into the vena cava; a purpose which is more fully answered in herbivorous animals in whom the abdominal circulation is more extensive, and the spleen is of larger dimensions and greater elasticity.

The splenic corpuscles are thickly scattered throughout the cellular parenchyma of this organ; and from each corpuscle there arises a minute lymphatic vessel; the interlacing of adjacent lymphatics giving rise to a fine and extensive net-work. The trunks of these vessels enter into the Malpighian glands, and again ramifying, form a lymphatic plexus in the interior of these bodies. The fluid contents of these vessels, which had been before pellucid, is now found to contain white organic globules, similar in every respect to those observed in the fluid of lymphatic glands in other parts of the body. The author considers the secretion of this fluid, which appears to be identical with the contents of the lymphatic glands, as being the peculiar function of the splenic parenchyma.

A few illustrative drawings and diagrams accompany this paper.

2. "On the Structure and Developement of the Nervous and Circulatory Systems, and on the existence of a complete Circulation of the Blood in Vessels in the Myriapoda and the Macrourous Arachnida." By George Newport, Esq. Communicated by P. M. Roget, M.D., Sec. R.S.

This paper is the first of a series which the author proposes to submit to the Royal Society on the comparative anatomy and the developement of the nervous and circulatory systems in articulated animals. Its purpose is, in the first place, to investigate the minute anatomy of the nervous system in the Myriapoda and the Macrourous Arachnida, and more especially with reference to the structure of the nervous cord and its ganglia; and thence to deduce certain conclusions with respect to the physiology of that system and the reflex movements in vertebrated animals; secondly, to demonstrate the existence of a complete system of circulatory vessels in the Myriapoda and Arachnida; and thirdly, to point out the identity of the laws which regulate the developement of the nervous and circulatory systems throughout the whole of the Articulata, and the dependence of these systems on the changes which take place in the muscular and tegumentary structures of the body, as, in a former paper, he showed was the case with regard to the changes occurring in the nervous system of true insects.

The first part of the paper relates to the nervous system. A description is given of this system in the Chilognatha, which the author was led, by his former investigations, to regard as the lowest order of the Myriapoda, and approximating most nearly to the Annelida. He traces the different forms exhibited by the nervous system in the principal genera of that order, the most perfect of which are connected on the one hand with the Crustacea, and on the other with true insects. Passing from these to the Geophili, the lowest family of the Chilopoda, which still present the vermiform type, the nervous system is traced to the tailed Arachnida, the Scorpions, through Scolopendra, Lithobius and Scutigera; the last of which tribes connects the Myriapoda on the one hand with the true insects, and on the other with the Arachnida. The brain and the visceral nerves, the coverings and structure of the cord and ganglia, and the distribution of the systemic nerves are examined in each genus, but more particularly in the Scorpion, in which the nerves of the limbs are traced to the last joints of the tarsi, and those of the tail to the extremity of the sting. Especial attention is bestowed on the structure of the cord and its ganglia, and their developement during the growth of the animal. In the lowest forms of the Iulidæ, in which the ganglia are very close together, and hardly distinguishable from the non-ganglionic portions of the cord, the author has satisfactorily traced four series of fibres, a superior, and an inferior one, and also a transverse and a lateral series. The superior series, which he formerly described in insects as the motor tract, he has assured himself is distinct from the inferior, which he regarded as the sensitive tract; this evidently appears on examining the upper and under sides of a ganglionic enlargement of the cord. On the upper surface the direction of the fibres is perfectly longitudinal; while the fibres on the under surface are enlarged, and curvilinear in their direction. But he remarks that it is almost impossible to determine by experiment whether these structures are separately motor and sensitive, as formerly supposed, or whether they both administer to these functions by an interchange of fibres. These two series appear also to be separated in each ganglionic enlargement of the cord by the third series, constituting the transverse or commissural fibres, which pass transversely through the ganglia, and of which the existence was first indicated by the author in his paper on the *Sphinx ligustri*, published in the Philosophical Transactions for 1834. The author states that, in addition to these, there is in each half of the cord another and more important series of fibres, which constitute a large portion of the cord, but of which the existence has hitherto entirely escaped observation. This series forms the lateral portion of each half of the cord, and differs from the superior and inferior series in the circumstance, that while those latter series are traceable along the whole length of the cord to the subœsophageal and cerebral ganglia, the former series extends only from the posterior margin of one ganglion to the anterior margin of the first or second beyond it; thus bounding the posterior side of one nerve and the anterior of another, and forming part of the cord only in the interval between the two nerves. From this circumstance, the author designates the fibres of this series, *fibres of reinforcement of the cord*. Every nerve proceeding from a ganglionic enlargement is composed of these four sets of fibres, namely, an upper and an under one, communicating with the cephalic ganglia; a transverse or commissural, which communicates only with corresponding nerves on the opposite side of the body; and a lateral set, which communicates only with nerves from another ganglionic enlargement on the same side of the body, and which forms part of the cord in the interspace between the ganglia. The author had long suspected that this latter set of fibres existed; but he had never, until lately, ascertained their presence by actual observation. Their action seems fully to account for the reflected movements of parts both anterior and posterior to an irritated limb; as that of the commissural set does the movements of parts situated on the opposite side of the body to that which is irritated. In the ganglia of the cord in Iulus and Polydesmus, the fibres of the inferior longitudinal series are enlarged and softened on entering the ganglion, but are again reduced to their original size on leaving it; thus appearing to illustrate the structure of ganglia in general. In the developement of the ganglia and nerves in these genera, and also in Geophilus, the same changes take place as those which were formerly described by the author as occurring in insects; namely, an aggregation of ganglia in certain portions of the cord, and shifting of the position of certain nerves, which at first exist at ganglionic portions of the cord, but afterwards become removed to a non-ganglionic portion. The nervous cord is elongated, in order that it may keep pace with the growth of the body, which is periodically acquiring additional segments: that this elongation takes place in the ganglia is proved by these changes of position in the nerves lying transversely across the ganglia. The author infers from these facts, that the ganglia are centres of growth and nourishment, as well as of reflex movements, and that they are analogous to the enlargements of the cord in the vertebrata.

A series of experiments on the Iulus and Lithobius are next related; the result of which shows that the two supra-œsophageal ganglia are exclusively the centres of volition, and may therefore strictly be regarded as performing the functions of a brain: so that when these ganglia are injured or removed, all the movements of the animal are of a reflex character. When, on the other hand, these ganglia are uninjured, the animal movements are voluntary, and there exists sensibility to pain: there is, however, no positive evidence that the power of sensation does not also reside in the other ganglia.

The second part of the paper relates to the organs of circulation. In all the Myriapoda and Arachnida the dorsal vessel or heart is divided, as in insects, into several compartments, in number corresponding to the abdominal segments. Its anterior portion is divided, immediately behind the basilar segment of the head, into three distinct trunks. The middle portion, which is the continuation of the vessel itself, passes forwards along the œsophagus, and is distributed to the head itself; while the two others, passing laterally outwards and downwards in an arched direction, form a vascular collar round the œsophagus, beneath which they unite in a single vessel, as was first noticed by Mr. Lord in the Scolopendra. This single median vessel lies above the abdominal nervous cord, and is extended backwards throughout the whole length of the body as far as the terminal ganglia of the cord, under which it is subdivided into separate branches accompanying the terminal nerves to their final distribution. Immediately anterior to each ganglion of the cord, this vessel gives off a pair of vascular trunks; and each of these trunks is divided into four arterial vessels, one of which is given to each of the principal nerves proceeding from the ganglion, and may be traced along with it to a considerable distance. Of these, the vessel situated most posteriorly is again connected with the great median trunk by means of a minute branch, so that the four vessels on each side form, with their trunks, a complete vascular circle above each ganglionic enlargement of the cord. Besides these, which may be regarded as the great arterial trunk and vessels conveying the blood directly from the anterior distribution of the heart to the limbs and inferior surface of the body, the author has also discovered a pair of large arterial vessels in each segment, originating directly from the posterior and inferior surface of each chamber of the heart. These vessels he has named *the systemic arteries*; and in the Scolopendra he has traced them from the great chamber of the heart, which is situated in the penultimate segment of the body, to their ultimate distribution and ramification in the coats of the great hepatic vessels of the alimentary canal.

After the blood has passed from the arteries, it is returned again to the heart in each segment of the body by means of exceedingly delicate transparent vessels, which pass around the sides of the segments and communicate with the valvular openings of each chamber of the heart at its upper surface, where the valvular openings are situated, not only in all the Myriapoda, but also in the Scorpionidæ. In Scorpions, the circulatory system is more complete and important than even in the Myriapoda. The heart, divided as in Myriapods into separate chambers, is lengthened out at its posterior extremity into a long caudal artery, and gives off a pair of systemic arteries from each chamber, precisely as in the Myriapoda. These arteries not only distribute their blood to the viscera, but send their principal divisions to the muscular structures of the inferior and lateral parts of the body, as well as to the pulmonary sacs. At the anterior part of the abdomen, the heart becomes aortic, descends suddenly into the thorax, and immediately behind the brain spreads out into several pairs of large trunks, which are given to the head, and to the organs of locomotion. The posterior of these trunks form a vascular collar around the œsophagus, beneath which they unite, anteriorly, to a strong bony arch in the middle of the thorax, to form the great arterial trunk, or supra-spinal vessel, which conveys the blood to the posterior part of the body, as in the Myriapoda. This vessel passes beneath the transverse bony arch of the thorax, and is slightly attached to it by fibrous tissue, which circumstance probably induced Professor Müller, who observed this structure in 1828, to regard it as a ligament. In its course backwards, along the nervous cord, this vessel is gradually lessened in size, until it arrives at the terminal ganglion of the cord in the tail, where it is divided into two branches, which take the course of the terminal nerves, and these are again subdivided before they arrive at their ultimate distribution. In addition to these parts, the author found a hollow fibrous structure, which closely surrounds the cord and nerves immediately after they have passed beneath the arch of the thorax. From the sides of this structure there pass off backwards two pairs of vessels, that get beneath the peritoneal lining of the abdominal cavity and are distributed on the first pair of branchiæ. A small vessel also passes backwards beneath the cava, and, being joined by anastomoses from the spinal artery, form the commencement of a vessel which the author formerly described in the 'Medical Gazette' as the *subspinal vessel.* This vessel, extending along the under surface of the nervous cord, communicates directly, by short vessels, with the supra-spinal artery, and gives off, at certain distances from its under surface, several large vessels, which unite with others that convey the blood which has circulated through the abdominal segments, directly to the branchiæ, whence it is returned to the heart by many minute vessels that originate from the posterior internal part of each branchia, and, united into single trunks, pass around the sides of the segments to the valvular openings on the dorsal surface of the heart. In the tail of the Scorpion there is a direct vascular communication between the caudal artery and the subspinal vein, which, from the direction of the vessels, induces a belief that there is some peculiarity in the circulation of the blood in this part of the body. Besides these vessels, the author found an arterial trunk that originates from the commencement of the aorta as it descends into the thorax. This vessel passes backwards along the alimentary canal, to which it is distributed, and gives off branches to the liver.

This paper is accompanied by five drawings, illustrating the anatomical facts which are described in it.

The Society then adjourned over the Easter Recess to meet again on the 27th instant.

In consequence of the lamented death of H. R. H. the Duke of Sussex, the Society did not resume their Meetings till the 11th of May.

May 11, 1843.

The MARQUIS OF NORTHAMPTON, President, in the Chair.

George Basevi, Esq., and Colonel John Le Couteur, were balloted for, and duly elected into the Society.

Edward Speer, Esq., was also balloted for, but not elected into the Society.

The following papers were read, viz.—

1. "Variations de la Déclinaison et Intensité Horizontale magnétique observées à Milan pendant vingt-quatre heures consécutives le 22 et 23 Mars, et le 19 et 20 Avril 1843." Par F. Carlini, For. Mem. R.S.

2. "Note regarding the Observations of T. Wharton Jones, Esq., F.R.S., 'On the Blood Corpuscles.'" By Martin Barry, M.D., F.R.S. L. & E.

The author observes, that the structure of the blood-corpuscles can be accurately learned only by a careful investigation of their mode of origin, and by following them through all their changes in the capillary vessels, and especially in the capillary plexuses and dilatations, where all their stages of transition from the colourless to the red corpuscles may be seen. The filament which forms here and there in the corpuscles of coagulating blood he has shown to other persons, with Microscopes made by Ross and Powell. Dr. Barry denies that he meant certain general remarks in his paper, referring to more than twenty delineations of corpuscles from various animals, to apply exclusively to those of man.

3. A paper was also in part read, entitled, "Experiments on the Gas Voltaic Battery, with a view of ascertaining the rationale of its action, and on its application to Eudiometry." By William Robert Grove, Esq., M.A., F.R.S., &c.

The President informed the Meeting that the Council had voted the following Address of Condolence to Her Majesty the Queen, on the occasion of the demise of His Royal Highness the Duke of Sussex:—

"*To the Queen's Most Excellent Majesty.*

"The humble Address of the President, Council, and Fellows of the Royal Society of London for improving Natural Knowledge.

"MOST GRACIOUS SOVEREIGN,

"We, Your Majesty's most dutiful and loyal subjects, the President, Council, and Fellows of the Royal Society of London for improving Natural Knowledge, beg leave to approach Your Majesty with the expression of our heartfelt condolence on the loss which Your Majesty has sustained by the lamented death of His Royal Highness the Duke of Sussex. In the expression of our sorrow we are sure that all Your Majesty's subjects must unite with us, when they regard the public and private virtues of His Royal Highness. We are bound to feel additional grief as a Society over which His Royal Highness had presided, and where he had uniformly shown the greatest zeal for the cause of knowledge, and the most amiable condescension and kindness to every cultivator of Physical Science."

May 18, 1843.

The MARQUIS OF NORTHAMPTON, President, in the Chair.

James Tulloch, Esq., was balloted for, and duly elected into the Society.

1. The reading of a paper, entitled "Experiments on the Gas

Voltaic Battery, with a view of ascertaining the rationale of its Action and on its application to Eudiometry." By William Robert Grove, Esq., M.A., F.R.S., &c., was resumed and concluded.

The author, referring to a paper published in the Philosophical Magazine for December 1842, giving an account of a voltaic battery of which the active ingredients are gases, and by which the decomposition of water is effected by means of its composition, describes several variations in the form of the apparatus recorded in that paper. The experiments he has made with this new apparatus, and the details of which occupy the greater part of the present memoir, he conceives establish the conclusion that the phenomena exhibited in the gaseous battery are in strict conformity with Faraday's law of definite electrolysis. They also confirm him in the opinion which he had expressed in his original paper, and which had been controverted by Dr. Schœnbein, in a communication to the Philosophical Magazine for March 1843, as well as by other philosophers, namely, that the oxygen, in that battery, immediately contributes to the production of the voltaic current. Besides employing as the active agents oxygen and hydrogen gases, he extends his experiments to the following combinations: namely,

Oxygen and peroxide of nitrogen;
Oxygen and protoxide of nitrogen;
Oxygen and olefiant gas;
Oxygen and carbonic oxide;
Oxygen and chlorine;
Chlorine and dilute sulphuric acid;
Chlorine and solutions of bromine and iodine in alternate tubes;
Chlorine and hydrogen;
Hydrogen and carbonic oxide;
Chlorine and olefiant gas;
Oxygen and binoxide of nitrogen;
Oxygen and nitrogen, with solution of sulphate of ammonia;
Carbonic acid and carbonic oxide, with oxalic acid as an electrolyte;
Hydrogen, nitrogen, and sulphate of ammonia.

The author concludes, on reviewing the whole of this series of experiments, that, with the exception, perhaps, of olefiant gas, which appears to give rise to an extremely feeble current, chlorine and oxygen, on the one hand, and hydrogen and carbonic oxide, on the other, are the only gases which are decidedly capable of electro-synthetically combining so as to produce a voltaic current. He thinks that the vapours of bromine and of iodine, were they less soluble, would probably also be found efficient as electro-negative gases.

He proceeds to consider, in the remaining part of his paper, the application of the gas battery to the purposes of eudiometry, founded on the circumstance already mentioned, that nitrogen gas, as well as several other gases, are absolutely without effect in as far as regards any alteration of their volume, and may therefore be advantageously employed in the analysis of atmospheric air, or other mixed gases. Several experiments of this nature are described, and others suggested for future trial. Various theoretical views, arising from this train of inquiry, are then discussed; particularly with reference to the contact theory, with which the author conceives that the action of the gas battery is not reconcileable; and also to the source of the caloric evolved during voltaic action, which he is strongly inclined to think is in the battery itself.

2. A paper was also read, entitled "Contributions to Terrestrial Magnetism." No. IV. By Lieut.-Colonel Edward Sabine, R.A., F.R.S.

In the present number of these contributions, the author resumes the consideration of Captain Sir Edward Belcher's magnetic observations, of which the first portion, namely, that of the stations on the north-west coast of America and its adjacent islands, was discussed in No. 2. The return to England of H.M.S. Sulphur by the route of the Pacific Ocean, and her detention for some months in the China Seas, have enabled Sir Edward Belcher to add magnetic determinations at thirty-two stations to those at the twenty-nine stations previously recorded.

The author first describes the experiments which he instituted with the different needles employed by Captain Sir Edward Belcher for determining the coefficient to be employed in the formula for the temperature corrections; and takes this opportunity of noticing the singular fact that, in needles made of a particular species of Russian steel, this coefficient is negative; that is, in these needles, an increase of temperature increases the magnetic power. M. Adolphe Erman describes this particular kind of steel as consisting of alternate very thin layers of soft iron and of steel, so that when heated the soft iron layers increase their magnetic intensity and the steel layers diminish theirs.

He next considers the more important question of the steadiness with which the needles may have maintained their magnetic condition. By intercomparison of the results obtained at various stations with the different needles employed, he assigns corrections to be applied to the determination of the magnetic force deduced from the observed times of vibration. The magnetic force thus corrected, from the observations with each of the needles employed at the various stations visited by Sir Edward Belcher, is then given in a general table of results. The observations of the inclination of the needle are given in another table; and a third table contains the determination of the declination and inclination of the needle, the horizontal and total magnetic intensity deduced from the observations at thirty-two stations, of which the latitudes and longitudes are given in the same table, together with the dates of observation.

May 25, 1843.

The MARQUIS OF NORTHAMPTON, President, in the Chair.

James Moncrieff Arnott, Esq., and Samuel Elliott Hoskins, M.D., were balloted for, and duly elected into the Society.

The following papers were read, viz.—

1. "Meteorological Journal, from January to April inclusive, 1843, kept at Guernsey." By Samuel Elliott Hoskins, M.D. Communicated by Samuel Hunter Christie, Esq., Sec. R.S.

2. "On the Respiration of the Leaves of Plants." By William Haseldine Pepys, Esq., F.R.S.

The author gives an account of a series of experiments on the products of the respiration of plants, and more particularly of the leaves; selecting, with this view, specimens of plants which had been previously habituated to respire constantly under an inclosure of glass; and employing, for that purpose, the apparatus which he had formerly used in experimenting on the combustion of the diamond, and consisting of two mercurial gasometers, with the addition of two hemispheres of glass closely joined together at their bases, so as to form an air-tight globular receptacle for the plant subjected to experiment.

The general conclusions he deduces from his numerous experiments conducted during several years, are, first, that in leaves which are in a state of vigorous health, vegetation is always operating to restore the surrounding atmospheric air to its natural condition, by the absorption of carbonic acid and the disengagement of oxygenous gas: that this action is promoted by the influence of light, but that it continues to be exerted, although more slowly, even in the dark. Secondly, that carbonic acid is never disengaged during the healthy condition of the leaf. Thirdly, that the fluid so abundantly exhaled by plants in their vegetation is pure water, and contains no trace of carbonic acid. Fourthly, that the first portions of carbonic acid gas contained in an artificial atmosphere, are taken up with more avidity by plants than the remaining portions; as if their appetite for that pabulum had diminished by satiety.

3. A paper was also in part read, entitled "On the minute Structure of the Skeletons or hard parts of the Invertebrata." Part II. By William B. Carpenter, M.D. Communicated by the President.

June 1, 1843.

The MARQUIS OF NORTHAMPTON, President, in the Chair.

Sir John P. Boileau, Bart., and the Rev. John Wright, M.A., were balloted for, and duly elected into the Society.

The following papers were read, viz.—

1. "Magnetic-term Observations for January, February, March, and April 1843," made at the Observatory at Prague, by Professor Kreil. Communicated by Samuel Hunter Christie, Esq., Sec. R.S.

2. "Hourly Meteorological Observations, taken between the hours of 6 A.M. March 17th, 1843, and 6 A.M. of the following day, being the period of the Spring Tides of the Vernal Equinox, at Georgetown, British Guiana." By Daniell Blair, Esq., the Colonial Surgeon, transmitted by Henry Light, Esq. Communicated by the Lords Commissioners of the Admiralty.

3. "On the minute structure of the Skeletons, or hard parts of Invertebrata." By W. B. Carpenter, M.D. Communicated by the President. Part II. "On the structure of the Shell in the several families and genera of Mollusca."

The author here gives in detail the results of his inquiries into the combinations of the component elements of shell as they are met with in the several families and genera of the Mollusca; and considers all these results as tending to establish the general proposition, that where a recognizable diversity presents itself in the elementary structure of the shell, in different groups, that diversity affords characters which indicate the natural affinities of the several genera included in those groups, and which may therefore be employed with advantage in classification, and in the recognition and determination of fossils.

The Society then adjourned over the Whitsun Recess, to meet again on the 15th instant.

June 15, 1843.

The MARQUIS OF NORTHAMPTON, President, in the Chair.

The following papers were read, viz.—

1. "On the supposed developement of the Animal Tissues from Cells." By James Stark, M.D., F.R.S.E. Communicated by James F. W. Johnston, Esq., M.A., F.R.S.

The author controverts the prevailing theory of the developement of animal tissues from cells, and denies the accuracy of the microscopical observations on which that theory is founded, as regards the anatomy of the adult as well as of the fœtal tissues. He asserts that at no period of fœtal life can rows of cells be discovered in the act of transformation into muscular fibres: and he denies that these fibres increase either in length or in thickness by the deposition of new cells. He contends that the ultimate filaments of muscles, as well as all the other tissues of the body, are formed from the fibrinous portion of the blood, which is itself composed of globules that are disposed to cohere together, either in a linear series, so as to form a net-work of fine filaments, or in aggregated masses of a form more or less globular, composing what have been termed fibrinous corpuscles. These corpuscles have been considered to be the nuclei of cells; but the author regards them as being merely accidental fragments of broken down tissues, adhering to the filaments, and noways concerned in their developement. The more regularly disposed granules, which are observed to occupy the spaces intervening between the filaments composing the ordinary cellular tissue, he considers as being fatty matter deposited within these spaces. He, in like manner, regards the observations tending to show the cellular origin of the fibrous, cartilaginous, and osseous tissues, as altogether fallacious; and maintains that the cells, which these animal textures exhibit when viewed under the microscope, are simply spaces occurring in the more solid substance of these structures, like the cavities which exist in bread. These views are pursued by the author in discussing the formation of the skin, the blood-vessels, and the nerves, and in controverting the theory of secretion, founded on the action of the interior surfaces of the membranes constituting cells.

2. "Contributions to Terrestrial Magnetism."—No. V. By Lieut.-Colonel Edward Sabine, R.A., F.R.S.

In this paper the author details and discusses the magnetic observations made on board Her Majesty's ships Erebus and Terror, between October 1840 and April 1841, being the first summer which the expedition under the command of Captain James Clark Ross, R.N., passed within the Antarctic Circle.

The elimination of the influence of the ship's iron in the calculation of the results of these observations occupies a considerable portion of the paper. Formulæ for this purpose are derived from M. Poisson's fundamental equations, and the constants in the formulæ are computed for each of the two ships, from observations made on board expressly with that object. With these constants, tables of double entry are formed for each of the three magnetic elements, namely, declination, inclination, and intensity, giving the required corrections of each, for all the localities of the voyage.

These and other corrections being applied, the results are tabulated and charts formed from them. The full consideration of the charts is postponed until the whole of the materials collected by the Antarctic Expedition shall be before the Royal Society. Meanwhile the paper concludes with the following general remarks, viz.

1. The observations of declination, particularly those which point out the course of the lines of 0 and of 10° east, indicate a more westerly position than the one assigned by M. Gauss in the 'Atlas des Erdmagnetismus,' for the spot in which all the lines of declination unite. The progression of the lines in the southern hemisphere generally, from secular change, is from east to west; the difference consequently is in the direction in which a change should be found in comparing earlier with more recent determinations.

2. The general form of the curves of higher inclination in the southern hemisphere is much more analogous to that in the northern than appears in M. Gauss's maps. For example, the isoclinal line

of $-85°$, instead of being nearly circular, as represented in the 3^{te} Abtheilung of Plate XVI. of the 'Atlas des Erdmagnetismus,' is an elongated ellipse, much more nearly resembling in form and dimensions the ellipse of 85° of inclination in the northern hemisphere in the same work, Plate XVI. 2^{te} Abtheilung. The analogy between the two hemispheres in the characteristic feature of the elliptical form of the higher isoclinal lines is the more important to notice, on account of the particular relation which appears to subsist in the northern hemisphere between the change in the geographical direction of the greater axis of the ellipse, and the secular changes of the inclination generally throughout the hemisphere. The present direction of the greater axis in the northern hemisphere, is nearly N.N.W. and S.S.E., or that of a great circle passing through the two foci of maximum intensity. In the southern hemisphere, the present direction of the greater axis differs little from E.S.E. and W.N.W.

3. Captain Ross's observations of the intensity do not appear to indicate the existence anywhere in the southern hemisphere of a higher intensity than would be expressed by 2·1 of the arbitrary scale. In this respect also the analogy between the two hemispheres appears to be closer than is shown in M. Gauss's maps, Plate XVIII. With respect to the direction of as much of the line of highest intensity (2·0) as it has been possible to draw with any degree of confidence from the observations now communicated, it will be found to be in almost exact parallelism with the isodynamic line of 1·7 in Plate III. of the author's report "On the Variations of the Magnetic Intensity," in the Report of the eighth meeting of the British Association, for 1838; which line was the highest of which the position could be assigned at that period for any considerable distance by the aid of the then existing determinations.

3. "An Account of several new Instruments and Processes for determining the Constants of a Voltaic Circuit," by Charles Wheatstone, V.P.R.S., Professor of Experimental Philosophy in King's College, London, Corresponding Member of the Royal Academy of Sciences at Paris, &c.

The author proposes in the present communication to give an account of various instruments and processes which he has employed during several years past for the purpose of investigating the laws of electric currents. He states that the practical object for which these instruments were originally constructed, was to ascertain the most advantageous conditions for the production of electric effects through circuits of great extent, in order to determine the practicability of communicating signals by means of electric currents to more considerable distances than had hitherto been attempted. Their use, however, is not limited to this special object, but extends equally to all inquiries relating to the laws of electric currents and to every practical application of this wonderful agent.

As the instruments and processes described by the author are all founded on Ohm's theory of the voltaic circuit, he commences with a short account of the principal results to which this theory leads, and shows how the clear ideas of electromotive forces and resistances, substituted for the vague notions of intensity and quantity which formerly prevailed, furnish us with satisfactory explanations of phenomena, the laws of which have hitherto been involved in obscurity and doubt. According to Ohm's system, the force of the current is equal to the sum of the electromotive forces divided by the sum of the resistances in the circuit. The several electromotive forces and resistances which enter into the circuit of a voltaic battery are then defined; and having frequent occasion to refer to the laws of the distribution of the electric current in the various parts of a circuit, when a branch conductor is placed so as to divert a portion of the current from a limited extent of that circuit, the author directs particular attention to these laws. After recommending several new terms in order to express general propositions, without circumlocution and with greater precision, the author states the method of obtaining the constants of a circuit employed by Fechner, Lenz, Pouillet, &c., and then proceeds to explain the new method he has himself adopted. The principle of this method is the employment of variable instead of constant resistances, bringing, thereby, the currents in the circuits compared to equality, and inferring from the amount of the resistance measured out between two deviations of the needle, the electromotive forces and resistances of the circuit according to the particular conditions of the experiment; a method which requires no knowledge of the forces corresponding to different deviations of the needle. To apply this principle, it is requisite to have a means of varying the interposed resistance, so that it may be gradually changed within any required limits. The author describes two instruments for effecting this purpose; one intended for circuits in which the resistance is considerable, the other for circuits in which it is small. The *Rheostat* (for thus the inventor names the instrument under both its forms) may also be usefully employed as a regulator of a voltaic current, in order to maintain for any required length of time precisely the same degree of force, or to change it in any required proportion; its advantages in regulating electro-magnetic engines and in the operations of voltatyping, electro-gilding, &c. are pointed out.

Various methods of measuring the separate resistances in the circuit, particularly that of the rheomoter itself, are next described; and it is shown that the number of turns of the rheostat requisite to reduce the needle of a galvanometer from one given degree to another, is an accurate measure of the electromotive force of the circuit. It is then proved that similar voltaic elements of various magnitudes, conformably to theory, have the same electromotive force; that the electromotive force increases exactly in the same proportion as the number of similar elements arranged in series; and that when an apparatus for decomposing water is placed in a circuit, an electromotive force, opposed to that of the battery, is called into action, which is constant in its amount, whatever may be the number of elements of which the battery consists. The electromotive forces of voltaic elements formed of an amalgam of potassium with zinc, copper and platina, a solution of a salt of the negative metal being the interposed liquid, are given; the last combination is one of great electromotive energy, and when a voltameter is interposed in the circuit, it decomposes abundantly the water contained in it. A still more energetic electromotive force is exhibited by a voltaic element, consisting of amalgam of potassium, sulphuric acid, and peroxide of lead. The author then shows, that if three metals be taken in their electromotive order, the electromotive force of a voltaic combination formed of the two extreme metals is equal to the sum of the electromotive forces of the two elements formed of the adjacent metals.

Among the instruments and processes described in the subsequent part of the memoir are the following. 1. An instrument for measuring the resistance of liquids, by which the errors in all previous experiments are eliminated, particularly those resulting from neglecting the contrary electromotive force arising from the decomposition of the liquid. 2. The differential resistance measurer, by means of which the resistances of bodies may be measured in the most accurate manner, however the current employed may vary in its energy. 3. An instrument for ascertaining readily what degree of the galvanometric scale corresponds to half the intensity indicated by any other given degree. 4. A means of employing the same delicate galvanometer to measure currents of every degree of energy, and in all kinds of circuits. 5. Processes to determine the deviations of the needle of a galvanometer corresponding to the degrees of force, and the converse.

4. "On the Organ of Hearing in Crustacea." By Arthur Farre, M.D., F.R.S.

The author finds that in the Lobster (*Astacus marinus*), the organ of hearing consists of a transparent and delicate vestibular sac, which is contained in the base, or first joint of the small antennæ; its situation being indicated externally by a slight dilatation of the joint at this part, and also by the presence of a membrane covering an oval aperture, which is the fenestra ovalis. The inner surface of the sac gives origin to a number of hollow processes, which are covered with minute hairs and filled with granular matter, apparently nervous. A delicate plexus of nerves, formed by the acoustic nerve, which is a separate branch supplied from the supra-œsophageal ganglion, is distributed over the base of these processes and around the sac. Within the sac there are always found a number of particles of siliceous sand, which are admitted, together with a portion of the surrounding water, through a valvular orifice at the mouth of the sac, being there placed apparently for the express purpose of regulating the size of the grains. The author considers these siliceous particles as performing the office of otolites, in the same way as the stones taken into the stomachs of granivorous birds supply the office of gastric teeth. Several modifications of this structure exhibited in the organs of hearing of the *Astacus fluviatilis*, *Pagurus streb-*

lonyx, and *Palinurus quadricornis* are next described, and an explanation attempted of the uses of the several parts and their subserviency to the purposes of that sense.

The author concludes by a description of another organ situated at the base of the large antennæ, which it appears has been confounded with the former by some anatomists, but which the author conjectures may possibly constitute an organ of smell. The paper is accompanied by illustrative drawings.

5. "A statement of Experiments showing that Carbon and Nitrogen are compound bodies, and are made by Plants during their growth." By Robert Rigg, Esq., F.R.S.

The author, finding that sprigs of succulent plants, such as mint, placed in a bottle containing perfectly pure water, and having no communication with the atmosphere except through the medium of water, or mercury and water, in a few weeks grow to more than double their size, with a proportionate increase of weight of all the chemical elements which enter into their composition, is thence disposed to infer that all plants make carbon and nitrogen; and that the quantity made by any plant varies with the circumstances in which it is placed.

6. "Physiological inferences derived from Human and Comparative Anatomy respecting the Origins of the Nerves, the Cerebellum, and the Striated Bodies." By Joseph Swan, Esq. Communicated by Richard Owen, Esq., F.R.S.

The author remarks that those parts of the nervous system which are concerned in motion and in sensation exhibit a great similarity in all vertebrate animals. To the first of these functions belong the anterior and middle portions of the spinal cord and medulla oblongata, including the anterior pyramids, the crura cerebri, and some fibres leading to the corpora striata and the convolutions, and also the cerebellum. To the function of sensation belong the posterior surface of the spinal cord, the posterior and lateral portions of the medulla oblongata, including the posterior pyramids, the ventricular cords, and the fourth and third ventricles.

From a general comparison of the relative magnitude and structure of these several parts in the different classes of vertebrated animals, the author infers that only a very small portion of the brain is necessary for the origins of the nerves, their respective faculties being generally derived near the place at which they leave the brain. These origins are traced in various cases, where, from peculiarities of arrangement or of destination, they present certain remarkable differences of situation.

The author is led to consider the cerebellum as an appendage to the brain, rather than to the medulla oblongata and spinal nerves, for it does not correspond with either the number or the size of the sensitive or motor nerves; and that it is not required for the intellect, for the special senses, for common sensation, or for volition, appears from its size bearing no proportion to the strength of any of these faculties. Neither is it concerned in digestion or assimilation, nor does its size present any relation with the heart, the lungs, the muscles, the limbs, the vertebræ, the ribs, or any other organ, not even those of reproduction.. As, however, its nervous connexions are principally with those parts which are exclusively subservient to the will, it is probable that it is concerned in the completion, and not in the commencement of the voluntary act. It is probable, also, that the principal crossing of impulses from one side to the other takes place in the medulla oblongata and the motor tracts of the brain. Some of the arrangements of its lobules may have reference to the paces and attitudes of different animals. The will, acting through the cerebral convolutions, sets in action certain muscles placed in proper directions; but the influence of the cerebellum is required for giving them steadiness amidst the alternations from one set to another, and especially when a slight change disturbs the centre of gravity, and until the balance is effectually restored by a subsequent act of the will operating on antagonist or other muscles. The cerebellum also constitutes an additional focus of nervous influence, and may, therefore, cooperate with the brain in increasing the vital powers, and imparting greater energy to the various functions of the body.

The author regards the corpus striatum as being a centre for conveying to the mind the perception of the motions of the limbs and of their different parts. He concludes with some remarks on the double crossings of the tracts of the centres of the nerves of the arms and legs, and the explanation given by these facts to various pathological phenomena.

7. "Nouveaux faits à ajouter à la Théorie de la Chaleur et à celle de l'Évaporation." Par Daniel Parat, Médecin à Grenoble. Communicated by the President.

The author commences by explaining his conception of the nature of heat, of which he gives the following definition:—"Mouvemens centraux obsculaires de la cohésion devenus extemporanément plus rapides, et dilatant de plus en plus tous les corps par une augmentation ainsi acquise de toutes les forces centrifuges." He adopts the theory that the evaporation of water in contact with air is a process identical with chemical solution, and adduces as evidence supporting his views various circumstances which are common both to evaporation and to the solution of a salt in water.

8. "On the nature and properties of Iodide of Potassium, and its general applicability to the cure of Chronic Diseases." By James Heygate, M.D., F.R.S.

The author has been led by his experience to estimate highly the medicinal properties of the iodide of potassium (which he prefers to the tincture of iodine) in various diseases, and thinks that when it is administered judiciously no deleterious effects are likely to arise from its use.

9. "Observations on the relation which exists between the Re-

spiratory Organs of Animals, and the preservation of independent Temperatures." By George Macilwain, Esq., Consulting Surgeon to the Finsbury Dispensary. Communicated by William Lawrence, Esq., F.R.S.

The author expresses his dissent from the prevailing opinion that the temperature maintained by animals above the surrounding medium is proportionate to the extent of their respiration; and adduces many instances among different classes of animals in which he can trace no such correspondence, and others, on the contrary, where increased powers of respiration appear to diminish instead of raising the animal temperature. Hence the author is disposed to regard respiration as a refrigerating rather than a heating process.

The Society then adjourned over the long vacation, to meet again on the 16th of November next.

INDEX TO VOL. IV.

Abbott (R.) on the variation of a triple integral, 42.
Acaroid resin, 163.
Achromatic eye-pieces, single, construction and use of, 195.
Actinograph, or self-registering photometer, for meteorological purposes, 209.
Actinometers, photometers, &c., incompetent to give absolute measures of either heat or light, 389.
Addison (W.) on the distribution of the air-passages, and of the modes of formation of the air-cells of the lungs, 381.
Aerolite, 134.
Afzelius (Dr. Adam), notice of the late, 18.
Ainsworth (W.), geological and botanical notes on Northern Syria, 57.
Air, inductive capacity of, 41.
Airy (G. B.), experiments on iron-built ships, for the purpose of discovering a correction for the deviation of the compass produced by the iron of ships, 140, 141.
—— on the theoretical explanation of an apparently new polarity of light, 239, 247.
—— on the rise and fall of the tides in the Thames, 330.
—— on the meteorological instruments at the Royal Observatory, Greenwich, with which the meteorological observations have been made from November 1840 to July 1841, 330.
—— on the laws of individual tides at Southampton and Ipswich, 445.
Albert of Saxe-Coburg and Gotha (H.R.H. Prince), the address of congratulation on the occasion of his Royal Highness's marriage with Her Majesty the Queen, 204; the answer of His Royal Highness, 205.
——, address of congratulation on the occasion of the late traitorous attack of an assassin, 237.
——, address of congratulation on the birth of the Princess Royal, 281.
Albert of Saxe-Coburg and Gotha (H.R.H. Prince), address of congratulation on the birth of the Heir to the Throne, 332.
——, address of congratulation on the providential escape of Her Majesty and His Royal Highness from the attack of an assassin, 392.
Algebraic series, on the summation of, 456.
Alderson (Dr.) on the difference of colour in different parts of the bodies of animals, 165.
Alison (Rev. A), notice of the late, 176.
Alkaline and earthy bodies in plants, on the formation of, 131.
Allenheads, meteorological journal for 1841 kept at, 221, 297, 371.
Alten, meteorological observations made at, 195, 229.
Amarythrine, chemical examination of, 233.
America, magnetical observations made on the north coast of, 4.
——, magnetic observations on the west coast of, and the adjacent islands, 288, 465.
Ammonia, resin of, 219.
——, its action on biniodide and perchloride of platinum, 380.
Animal tissues, the non-vascularity and peculiar uniform mode of organization and nutrition of, 308.
—— tissues, on the supposed developement of from cells, 468.
Animalcule, parasitic, of the human skin, a newly discovered, 455.
Animals, on the difference of colour in different parts of the bodies of, 165.
——, on the relation between the respiratory organs of, and the preservation of independent temperatures, 474.
Anniversary Meetings: Nov. 30, 1837, 4; Nov. 30, 1838, 84; Nov. 30, 1839, 167; Nov. 30, 1840, 250; Nov. 30, 1841, 331; Nov. 30, 1842, 399.

Antarctic scientific Expedition, proposed by the British Association and the Royal Society to Her Majesty's Government, 169, 252, 401.
——, hints and instructions drawn up for the guidance of the, 169, 253.
—— seas, a vessel sent out by Mr. Enderby for the purposes of discovery in the, 253.
Arachnida, on the circulation of the blood in the, 458.
Archil, chemical history of, 233, 337.
Ardwick, description of the observatory at, 371.
Arseniates, on the, 162.
Assafœtida, resin of, 219, 241.
Astacus marinus, on the organ of hearing of, 472.
Astronomical refractions, on, 60.
—— clock, description of an, 221.
Atkinson (J.) on a rain table and map, 221.
Atmosphere, on the transparency of the, and the law of extinction of the solar rays in passing through it, 389.
Atmospheric pressure, influence of the moon on the, 395.
Attractions, on calculations of, 289.
Aurora Australis, notices of the, in March 1841, 395.
Aurora borealis, geometrical measurement of the height of, 162.
——, on the phenomena of the, 230.
——, on a remarkable appearance of the, 382.
Azoerythrine, chemical examination of, 233.
Azolitmine, 234.
Azote, the equivalent numbers of, 123.

Baily (F.), description of a new barometer fixed up in the apartment of the Royal Society, with an account of the mode now adopted for correcting the observed height of the mercury, 1.
Bakerian Lecture: Mr. Ivory on the theory of astronomical refractions, 60.
——, Mr. W. Snow Harris on the elementary laws of electricity, 156.
——, Mr. Airy on the theoretical explanation of an apparently new polarity of light, 239.
——, Mr. G. Newport on the organs of reproduction, and on the development of the Myriapoda, 326.
——, Prof. J. D. Forbes on the transparency of the atmosphere, and the law of extinction of the solar rays in passing through it, 389.
Barometer, description of a new one, fixed up in the apartments of the Royal Society, 1.
——, on the mode in which observations have been recorded in the Meteorological Journal of the Society, 2.
——, the Society's, its height above the mean level of the sea, 2.
——, compensating, description of a, 133.
——, hourly observations at sea of the, 239.
——, on variations of the mean height of, 211, 226.
——, on a cycle of eighteen years in the mean annual height of the, 292.
——, on a remarkable depression of the, 292.
——, on an irregularity in the height of the, 295.
—— and thermometer, Coggan's, 72.
Barometrical observations taken at Naples, 303.
—— observations at Yarmouth, 369.
—— observations, showing the effect of the direction of the wind on the difference between distant barometers, 386.
Baroscope, hydropneumatic, description of a, 126.
Barrow (Sir J.), magnetic observations, 220.
Barry (Dr. M.), researches in embryology, 73, 136, 222, 279.
——, a Royal medal awarded to, 172.
—— on the corpuscles of the blood, 234, 283, 323, 462.
——, a contribution to the physiology of cells, 222, 279.
—— on the discovery of the germinal spot in the mammiferous ovum, 279.
—— on the chorda dorsalis, 282.
—— on fibre, 362, 384, 431.
——, spermatozoa observed within the mammiferous ovum, 432.
—— on fossiparous generation, 441.
——, note on the observations of T. W. Jones, Esq., 462.
Batten (Rev. Dr. J. H.), notice of the late, 15.
Bauer (F.), biographical notice of, 342.
Bdellium, resin of, 241.
Becquerel (M.), the Copley medal

awarded to, for his memoirs on electricity, 22.
Belcher (Capt.), magnetic observations on the west coast of America and the adjacent islands, 288, 465.
——, boring register, Bow Island, South Pacific, 399.
——, remarks upon the tides at Tahiti, 440.
Bell (A.) on rotatory motion, 66.
Bell (Sir C.) on the nervous system, 217, 218.
——, biographical notice of, 402.
Benzoin, resin of, 241; action of caustic lime on, 242; action of caustic potash on, 242; action of oxide of lead on, 242.
Berengela resin, 219.
Bibasic salts, 102.
Bicyanide, new equi-atomic compound of, with binoxide of mercury, 135.
Binocular vision, on, 76.
Binoxide of mercury, new equi-atomic compound of bicyanide with, 135.
Biographical notices of deceased Fellows, 10, 92, 173, 256, 341, 402.
Birds of Kerguelen's Land, 298.
—— collected between the Cape of Good Hope and Van Diemen's Land, 305.
Blair (D.), hourly meteorological observations taken at Georgetown, British Guiana, 467.
Blake (J.) on the mode of operation of poisons, 155.
—— on the action of certain inorganic compounds when introduced into the blood, 284, 285.
Blindness, congenital, on the cure of, 303.
Blood, examination of the, in the different forms of fever accompanying inflammation and suppuration, 67.
——, experiments on the, in connexion with the theory of respiration, 78.
——, on the corpuscles of the, 234, 283, 323, 431, 462.
——, progressive division of the blood-disc into globules, 234; rapid and incessant changes in the form of altered blood-corpuscles, 234; the chorion formed of cells derived from corpuscles of the blood, 235; muscular fibre formed of cells derived from corpuscles of the blood, 235; state of the blood-corpuscles during vital turgescence of the vessels, 235.
Blood, on the motion of the, 140.
——, action of certain inorganic compounds when introduced into the 285.
——, facts observed in the coagulation of the, 384.
——, on the circulation of the, in the Myriapoda and the Macrourous Arachnida, 460.
Blood-corpuscles of certain species of the genus Cervus, on, 199.
——, observations on, particularly with reference to the opinions of Dr. Barry, 431.
——, note on the observations of T. W. Jones, Esq., on the, 462.
Blood-particles of the Ornithorhynchus hystrix, on the form of, 232.
Blumenbach (J. F.), biographical notice of, 265.
Bone, normal and adventitious, structure of, 198.
Booth (J.) on the rectification and quadrature of the spherical ellipse, 387.
Boring register, Bow Island, South Pacific, 399.
Bowditch (Dr. N.), biographical notice of, 95.
Bowerbank (J. S.) on the organic tissues in the bony structure of the Corallidæ, 382, 383.
Bowman (W.) on the minute structure and movements of voluntary muscles, 244, 301.
—— on the structure and use of the Malpighian bodies of the kidney, 374, 375.
——, a Royal medal awarded to, 422.
Bowring (J. C.) on a new method of determining the longitude, 52.
Boys (Rev. T.) on the steam-wave, 372.
Brain, on the decussation of fibres at the junction of the medulla spinalis with the medulla oblongata, 71.
Brazil, magnetical observations made on the coast of, 4.
Brewster (Sir David) on the colours of mixed plates, 33.
—— on a remarkable property of the diamond, 291.
—— on the phenomena of thin plates of solid and fluid substances exposed to polarized light, 302.
Bristol, tide observations at, 73, 242.
Broughton (J. D.), notice of the late, 17.
Brown (R.), a Royal medal awarded

to, for his discoveries in vegetable impregnation, 173.
Brush, electric, 52, 55.
Brussels, variation of the magnetic declination and horizontal intensity at, 329.
Bunt (T. G.), description of a new tide-guage constructed by, 53.
——, on tide observations made at Bristol by, 73, 242.
Burnes (Sir A.), notice of the late, 413.
Butler (Dr. S., Bishop of Lichfield), notice of the late, 258.

Calculating machine, description of a, 243, 362.
Calculi, on the decomposition and disintegration of, 442.
Californias and Mexican coasts of the Pacific, geographical position of the principal points of the, 196.
Calotype pictures, method of obtaining, 312.
—— paper, preparation of, 312; its use, 313; fixing process, 314.
Calorific rays in the solar spectrum, on the distribution of the, 209.
Calorific spectrum, account of a process for rendering it visible, 209.
Cambium, on the descent of the, in plants, 449.
Cape of Good Hope, meteorological observations at, 374, 380.
Cape Palmas, daily thermometrical observations at, 331.
Carbon and nitrogen, compound bodies, 472.
Carlini (Prof.), magnetic-term observations made at Milan, 280, 311.
——, variation of the magnetic declination, horizontal intensity and inclination at Milan, 282, 294, 298, 329, 362, 371, 435, 456, 462.
——, observations on magnetic direction and intensity made at Milan, 295, 298.
Carlisle (Sir A.), notice of the late, 260.
Carpenter (Dr. W. B.) on the minute structure of the skeletons of the Invertebrata, 435, 466, 467.
Carson (Dr. J.) on the motion of the blood, 140.
Cartilage, articular, the non-vascularity and peculiar uniform mode of organization and nutrition of, 308.
——, fibro-, on the structure of, 309.
Cartilage, the elements of, compared with corpuscles of the blood, 324.
Cassini's (Dr.) theory of the astronomical refractions, 60.
Catton (Rev. Thomas), notice of the late, 94.
Cellular tissue, the elements of, compared with corpuscles of the blood, 324.
Cells, on the physiology of, 222, 279.
Cerebellum, an appendage to the brain rather than to the medulla oblongata and spinal nerves, 473.
Cervus, genus, on the blood-corpuscles of the, 199.
Chantrey (Sir F.), notice of the late, 341.
Chemical action of the rays of the solar spectrum on preparations of silver, &c., 205.
—— action, the source of power in the voltaic pile, 200, 213; sufficiency of, to produce voltaic currents, 215.
—— constitution of bodies which undergo vinous fermentation, 149.
—— equivalents of certain bodies, on the, 123.
—— history of archil and litmus, 233, 337.
—— history of the compounds of palladium and platinum, 379.
—— rays of light, on their application to the purposes of pictorial representation, 131.
—— theory of voltaic electricity, 201; contact theory, 200.
Children (J. G.), his retirement from the office of Secretary, 10.
Chinese lute, on the, 297.
Chlorates, conversion of into chlorides, applied to the determination of equivalent numbers, 119.
Chlorides, conversion of into nitrates, applied to the determination of equivalent numbers, 119.
Chlorine, the equivalent numbers of, 123.
——, action of, on azolitmine and orceine, 234.
——, its action upon the ferrocyanate of potassa, 239.
Chorda dorsalis, on the, 282.
Christie (S. H.) on the importance of a more accurate determination of the variation of the magnetic needle, and likewise of the dip and of the intensity of terrestrial magnetism, 21.

Chrysotype, a new photographic process, 394, 397, 398.
Chorion, the, 76, 139.
——, formed of cells arising in the oviduct, 225.
——, on its formation out of cells, 279.
Chronic diseases, application of iodide of potassium to the cure of, 473.
Claudet (A.), new mode of preparation of the Daguerréotype plates, 315.
Ciliary processes, the elements of the, compared with corpuscles of the blood, 324.
Circle, computation of the ratio of the diameter to the circumference to 208 places of decimals, 302.
Circulation of the blood in the Myriapoda and Arachnida, 458.
Climate of London, on a cycle of eighteen years in the mean annual height of the barometer in the, and on a constant variation of the barometrical mean according to the moon's declination, 292.
——, on the prevailing winds, mean temperature and depth of rain in the, 300.
Clock, description of an escapement for an astronomical, 221.
——, electro-magnetic, 249.
Clouds, stationary, on, 33.
Coal and fossil wood, imbedded in igneous rocks, 299.
Coggan's (J.) self-registering thermometer and barometer, 72.
Colebrooke (H. T.), notice of the life and works of, 10.
Colours of mixed plates, on, 33.
——, on Nobili's plate of, 195.
——, vegetable, action of the rays of the solar spectrum on, 393, 397.
—— of flowers, of the, in general under the action of the spectrum, 393.
Comet of 1843, 450, 456.
Compass, experiments for discovering a correction for its deviation in iron-built ships, 141.
Conchoidal surface, geometrical and mechanical elements of a, 81.
Conduction, electrolytic, 50.
——, or conductive discharge, 50.
Conductors and insulators, analogy of, 50.
Conferva crispa of Dillwyn, 238.
Conferva fluviatilis of Linnæus, 238.
Constant battery, Daniell's, 23.
——, account of the effects of a large, 147.
Constantinople, results of meteorological observations at, 293.
Contact theory of voltaic electricity, 200; chemical theory, 201.
Convection, or carrying discharge, 56.
Cooper (Sir A. P.), biographical notice of, 344.
Cooper (J. T.), description of a hydropneumatic baroscope, 126.
Cooper (J. S.) on the visibility of certain rays beyond the ordinary red rays of the solar spectrum, 146.
Copley Medals, awarded to M. Becquerel, 22; to J. F. Daniell, Esq., 23.
——, awarded to Prof. Gauss, 99; to Prof. Faraday, 100.
——, awarded to Prof. Liebig and to M. Sturm, 255.
——, awarded to Dr. G. S. Ohm, 336.
——, awarded to Prof. MacCullagh, 419.
Corallidæ, on the organic tissues in the bony structure of the, 383.
Copper, on the reduction of, 447.
Cordilleras, heights of the principal points of, 196.
Cornea, the, a non-vascular animal tissue, 310.
Cornwall, electric conditions of the rocks and metalliferous veins of mines in, 317.
Corpus luteum, elements of the, derived from corpuscles of the blood, 324.
Council and Officers of the Royal Society:—for 1837–38, 28; for 1838–39, 105; for 1839–40, 184; for 1840–41, 272; for 1841–42, 355; for 1842–43, 423.
Council of the Royal Society, their statement relative to Mr. Panizzi's pamphlet, 18.
——, report of their proceedings, 21, 99, 332.
——, report on the state of the Society's library, 333.
Crozier (Capt. T. B. M.), meteorological observations taken on board H.M.S. Terror, 293, 374.
Crustacea, on the organ of hearing in, 471.
Crystalline lens, a non-vascular animal tissue, 310.

Crystallography, on the theory of, 116.
Curvature of surfaces, on, 112.
Cuvier (M. F.), biographical notice of, 98.
Cyanotype, a photographic process, 397, 398.

Daguerréotype plates, new mode of preparation of, 315.
Dalrymple (John) on the nerves of the uterus, 323.
Dalton (Dr.) on the phosphates, 162.
—— on the arseniates, 162.
——, a portrait of, presented to the Royal Society, 333.
Daniell (Prof.), a Copley medal awarded to, 23.
—— on voltaic combinations, with reference to the mutual relations of the generating and conducting surfaces, 43.
——, account of the effects of a large constant battery, 147.
—— on the electrolysis of secondary compounds, 153, 231.
—— on voltaic combinations, 43, 147, 383, 384.
——, a Royal medal awarded to, 422.
Darwin (C.) on the parallel roads of Glen Roy, 122, 127.
Davidson (John), notice of the late, 17.
Davy (Dr. John) on the male organs of some of the cartilaginous fishes, 129.
—— on the form of the blood-particles of the Ornithorhynchus hystrix, 232.
—— on the torpedo, 291.
——, experiments on the blood in connexion with the theory of respiration, 78.
Davy (Rev. M.), notice of the late, 173.
DeCandolle (A.P.), biographical notice of, 346.
Decidua, anatomy and physiology of the, 370.
Decomposition, vegetable, influence of nitrogen in promoting, 148.
DeMorgan (A.), description of a calculating machine, 243.
Diamond, on a remarkable property of the, 291.
—— mines of Golconda, 280.
Differential resistance measurer, 471.
Dip of magnetic needle in the West Indies, on the North coast of Brazil and North America, 4.
Disc, the, of Prof. Baer, 75.
Discharge (electric), conductive, 50; disruptive, 50, 51, 55; electrolytic, 50; difference of, at the positive and negative surface of conductors, 54; spark, 51; brush, 52, 55; glow, 55; dark, 56; convective, 56.
Discs, primitive, in blood-corpuscles exhibit an inherent contractile power, 324.
Dollond (G.), a portrait of, in the possession of the Royal Society, 402.
Donation Fund, some observations to call attention to the, 372.
Drach (S. A.) on the diurnal temperature of the earth's surface, 377, 444.
Dragon's blood, resin of, 136.
Drawing, photogenic, 120, 124.
Dulong (P. L.), biographical notice of, 97.
Dumfries, account of the hurricane of January 7, 1839, 123.
Dunlop (J.), observations of the dip and intensity made at sea, between England and Australia, 212.

Earle (H.), notice of the late, 95.
Earth, on the diurnal temperature of the, 377, 444.
——, on the figure of the, 289.
——, on the state of the interior of the, 83, 115, 129, 367.
Earthquake in one of the Scilly Islands, 122.
Earthy and alkaline bodies, on the formation of, with reference to their presence in plants, 131.
Eldon (Earl of), notice of the late, 94.
Electrical induction, specific, Prof. Faraday's discovery of, 37, 100.
Electric charge, penetration of, within a dielectric, 39.
—— conditions of the rocks and metalliferous veins of mines in Cornwall, 317.
—— current, nature of, 56; transverse force of, 56.
—— currents, Dr. Ohm's researches into the laws of, 336.
—— force of the Gymnotus, on the character and direction of the, 111.
—— force, experimental relation of, to nervous force, 112.
—— force or forces, nature of, 77;

relation of the electric and magnetic forces, 78.
Electric inductive capacity, specific, of certain substances, 40, 392.
Electricity evolved by the friction of water and steam against other bodies, 437.
——, M. Becquerel's memoirs on, 22.
——, on the elementary laws of, 156.
——, on the odour accompanying, 226.
——, Prof. Faraday's researches in, 37, 49, 54, 77, 111, 200, 213, 437.
——, voltaic, contact theory of, 200; chemical theory of, 201.; on the production of heat by, 280.
Electro-chemical equivalents, on, 232.
Electrolysis of secondary compounds, 153, 231.
Electrolytic discharge, 50.
Electro-magnetic clock, 249.
Electrometer, 38.
——, hydrostatic, 156.
——, micrometer, 193.
Electro-nitrogurets, on, 286.
Elemi resin, 241.
Ellipse and the hyperbola, method of proving the three leading properties of the, 443.
——, spherical, on the rectification and quadrature of the, 387.
Ellipsoids of equilibrium, on, 34.
Embryo, first rudiments of the, not two halves, 283.
Embryology, researches in, 73, 136, 222, 279.
Emys Benstedi, a remarkable fossil turtle, 305.
Epithelium tables, cells and cylinders, compared with corpuscles of the blood, 324.
Equations, numerical, new method of solving, 300.
Equivalents, chemical, on, 119, 123.
Erratic boulders of Lochaber, 128.
Erythrine, chemical examination of, 233.
Erythroleic acid, chemical examination of, 233.
Erythrolein, 234.
Erythryline, chemical examination of, 233.
Erythrolitmine, 234.
Escapement for an astronomical clock, description of an, 221.
Eudiometry, application of the gas battery to, 464.
Euphorbium resin, 241.
Evans (Dr. W. J.) on the general and minute structure of the spleen, 456, 457.
Exley (T.) on a new theory of physics, 325.
Eye, on the structure and mode of action of the iris, 439.
——, on the cure of congenital blindness, 303.
——, on the anatomy and physiology of certain structures in the orbit, 311.

Factorial expressions, on, 456.
Falkland Islands, meteorological journal kept at, 330.
Fallopian tube of the rabbit, ova found in the, 222.
Faraday (Prof.), researches in electricity (11th Series), 37; (12th Series), 47, 49; (13th Series), 53, 54; (14th Series), 77; (15th Series), 111; (16th Series), 200; (17th Series), 213; (18th Series), 437.
——, a Copley medal awarded to, for his discovery of specific electrical induction, 100.
——, chemical account of the Cold Bokkeveld meteoric stone, 134.
Farnborough (Lord), notice of the late, 94.
Farquharson (Rev. Dr. J.), on a geometrical measurement of the height of the aurora borealis, 162.
——, on the localities affected by hoar-frost, 293, 294.
——, on ground-gru, or ice formed at the bottom of running water, 295.
——, on a remarkable appearance of the aurora borealis below the clouds, 382.
Farre (A.) on the organ of hearing in Crustacea, 471.
Fecundation, changes in the ovarian ovum preparatory to, 222; point of, 222; changes in the ovum immediately after, 223.
Fellows of the Royal Society admitted, 4, 85, 168, 251, 340, 400.
——, table showing their number in 1837, 32; in 1838, 109; in 1839, 251; in 1840, 277; in 1841, 360; in 1842, 428.
——, Foreign Members admitted, 5, 168, 252, 400.
Fellows of the Society, deceased, list of, 4, 85, 167, 251, 340, 399.

Fermat, on a theorem of, 290.
Fermentation, vinous, 150, 165.
Fibre, on, 362, 384, 431.
Fibres, decussation of, at the junction of the medulla spinalis with the medulla oblongata, 71.
Fielding (Dr. G. H.) on the epidemic influenza at Hull, 381.
Ferrall (J. M.) on the anatomy and physiology of certain structures in the orbit, 311.
Figure of equilibrium, on determining the, 158.
—— of the earth, on the, 289.
Fish, cartilaginous, on the male organs of, 129.
Fisher (Rev. G.), magnetical observations of Capt. Sir E. Home, Bart., reduced by, 4.
Fluid, on the conditions of equilibrium of an incompressible, 157.
Fogs, on the formation of low, 33.
Forbes (Prof. J. D.), the Rumford medal awarded to, for his discoveries in the polarization and double refraction of heat, 104.
——, on the transparency of the atmosphere and the law of extinction of the solar rays in passing through it, 389.
Fossil remains of the Iguanodon and Hylæosaurus, 290.
—— remains of turtles, 305.
—— wood and coal imbedded in igneous rocks, 299.
Fossiparous generation, on, 441.
Fowler's (T.) calculating machine, 243.
Frankincense, consists of two acid resins, 163.
Franz (Dr. J. C. A.) on the case of a gentleman born blind, and successfully operated upon in the 18th year of his age, 303.
Friction of water and steam against other bodies, on the electricity evolved by, 437.
Frodsham (W. J.) on the vibration of the pendulum, 78.

Galbanum, resin of, 241.
Gambodic acids, 163.
Gamboge, resin of, 163; chemical formula of, 163.
Ganglia, nervous, of the uterus, 321, 395.
Garden (P.), account of the hurricane at Dumfries, Jan. 7, 1839, 123.
Gas voltaic battery, on the, 463.
Gases, inductive capacity of, 41.
Gassiot (J. P.) on the possibility of obtaining a spark before the circuit of the voltaic battery is completed, 193.
—— on Nobili's plate of colours, 195.
Gauss (Prof.), a Copley medal awarded to, for his researches in magnetism, 99.
Generation, fossiparous, on, 441.
Geology, on the parallel roads of Glen Roy, and of other parts of Lochaber, 127.
—— of Kerguelen's Land, 299, 305.
——, Notes on Northern Syria, 57.
——, physical, on the state of the interior of the earth, 83.
——, physical, on the phenomena of precession and nutation, assuming the fluidity of the interior of the earth, 115, 129, 367.
Geometrical forms of turbinated and discoid shells, on the, 79.
Germ, the, or foundation of the new being, 223; comparison of the germs of animals and plants, 226.
Germinal vesicle and its contents, the most primitive portion of the ovum, 74.
—— vesicle and spot, changes in, preparatory to fecundation, 222; after fecundation, 223; not a nucleus but a parent cell, 223.
—— in birds, batrachian reptiles and osseous fishes, 242.
Gibraltar, wind table from observations taken at, 432.
Gilbert (Davies), biographical notice of, 256.
Gillies (Lieut.) on the variation of the magnetic needle, 437.
Glen Roy, on the parallel roads of, 127.
Glow, electric, 55.
Golconda, on the diamond mines of, 280.
Gold, on the reduction of, 447.
Graafian vesicle, 74; of mammals, how related to the calyx of birds, amphibia and fishes, 74; the order of formation of the more permanent parts of the ovum and the Graafian vesicle in mammalia, 76.
Graham (Prof. Thomas), a Royal medal awarded to, for his inquiries respecting the constitution of salts; of oxalates, &c., 102.

Ground-gru, or ice formed at the bottom of running water, 295.
Grove (W. R.) on some electro-nitrogurets, 286.
—— on the gas voltaic battery, 463.
Grover (Capt. J.), notice of the comet of 1843, 456.
Guaiacum, resin of, 163.
——, action of light on a solution of this resin spread on paper, 393.
Guernsey, meteorological journal kept at, 466.
Guiana, meteorological observations taken at Georgetown, 467.
Gulliver (G.) on suppuration, 67.
—— on the blood-corpuscles of certain species of the genus Cervus, 199.
Gymnotus, character and direction of the electric force of, 111.

Hæmadynamometer of Poiseuille, 285.
Haggard (W. D.), experiments made on a piece of Peña silver, 119.
Hake (Dr.) on the structure and functions of the spleen, 164.
Hall (C. R.) on the structure and mode of action of the iris, 439.
Halliwell (J. O.), a catalogue of the manuscripts in the library of the Royal Society made by, 253, 334.
Hanson (Prof.) on a new method of computing the perturbations of the planets, 435.
Harding (Col. G. J.), wind table from observations taken at Gibraltar, 432.
Hardy (P.) on a new and general notation applicable to the doctrine of life contingencies, 198.
Hargreave (C. J.) on the calculation of attractions, and the figure of the earth, 289.
Harris (W. S.) on the elementary laws of electricity, 156.
—— on the specific inductive capacities of certain electric substances, 392.
Hearing, the organ of, in Crustacea, 471.
Heat, on the production of, by voltaic electricity, 280.
——, Prof. Forbes's discoveries in the polarization and double refraction of, 104.
Hennell (H.), notice of the late, 419.
Henning (Capt. A.), meteorological register kept during a voyage from London to Calcutta and back to London, 329.
Henwood (W. J.) on the electric conditions of the rocks and metalliferous veins (lodes) of mines in Cornwall, 317.
Herschel (Sir J. F. W.) on the art of photography, 131.
—— on the chemical action of the solar spectrum on preparations of silver, &c., 203, 205.
——, a Royal medal awarded to, 255.
—— on the action of the rays of the solar spectrum on vegetable colours, 393, 397.
—— on improvements in photographic processes, 398.
—— on an extraordinary luminous appearance [the Great Comet] in the heavens on the 17th of March, 1843, 450.
Heygate (Dr. J.) on the nature and properties of iodide of potassium, and its applicability to the cure of chronic diseases, 473.
Hibbert, (G.), notice of the late, 93.
Hilton (J.) on the decussation of fibres at the junction of the medulla spinalis with the medulla oblongata, 71.
Hoar-frost, on the localities affected by, 294.
Hoare (Sir R. C.), notice of the late, 93.
Hodgkinson (Eaton) on the strength of pillars of cast iron and other materials, 227.
——, Royal medal awarded to, 338.
Hogg (J.) on the action of light upon the colour of the river sponge, 72.
Holland (Lord), notice of the late, 264.
Home (Capt. Sir J.E., Bart), magnetic observations made in the West Indies, on the Coasts of Brazil and North America, 4.
Hoofs, the, one of a class of non-vascular animal tissues, 310.
Hopkins (W.) on the state of the interior of the earth, 83.
—— on the phenomena of precession and nutation, assuming the fluidity of the interior of the earth, 115, 129, 367.
Horse, on the markings of the eel-back dun variety of, 163.
Hoskins (Dr. S. E.) on the decomposition and disintegration of phosphatic vesical calculi, 442.
——, meteorological journal kept at Guernsey, 466.

Howard (Luke) on the wet summer of 1839, 203.
—— on variations of the mean height of the barometer and mean temperature and depth of rain, from 1815 to 1823, 211.
—— on the variation, through a cycle of nine years, of the mean height of the barometer, mean temperature, and depth of rain, 226.
—— on a cycle of eighteen years in the mean annual height of the barometer in the climate of London, and on a constant variation of the barometrical mean according to the moon's declination, 292.
—— on a remarkable depression of the barometer, 292.
—— on the prevailing winds, mean temperature and depth of rain in the climate of London, 299, 300.
Howlett (S. B.), description of a compensating barometer, 133.
Hull, on the epidemic influenza at, 381.
Humboldt (Baron), his visit to the Royal Society, 370.
——, his proposal for the establishment of magnetical observatories, 9, 170.
Hume (Sir A.), notice of the late, 94.
Hunt (R.) on the influence of iodine in rendering argentine compounds, spread on paper, sensitive to light, 239.
Hurricane at Dumfries, Jan. 7, 1839, account of the, 123.
Hydraulic theory of shells, 81.
Hydriodic salts, of the whitening power of, on paper prepared by the action of solar light, 208.
Hydrogen, the equivalent numbers of, 123.
Hydropneumatic baroscope, description of a, 126.
Hygrometer (the Royal Society's), on the position of the, 3.
Hylæosaurus, or Wealden lizard, 290.

Ice at the bottom of running water, 295.
Iguanodon, on the lower jaw of the, 290.
India, on the Régar or black cotton soil of, 53.
——, papers from the magnetic observatories in, 361.
Indian seas, on tide observations made in the, 153, 217.
Induction, on, 37, 49, 54.
——, electrolytic, 51.
——, an action of contiguous particles, 38, 42; in curved lines, 39.
——, electric, 156.
Inductive capacity, specific, 40,392; of shell-lac 40; of glass, 41; of sulphur, 41; of oil of turpentine 41; of naptha, 41; of air, 41; of gases, 41.
—— apparatus, 38.
Inductometer, differential, 59, 100.
Influenza, epidemic, at Hull, 381.
Insulation, electric, 50.
Insulators and conductors, analogy of, 50.
Integral, triple, on the variation of a, 42.
Invertebrata, on the minute structure of the skeletons of the, 435, 467.
Iodide of potassium, on the nature and properties of, 473.
Iodine, its influence in rendering argentine compounds, spread on paper, sensitive to light, 239.
Iodized paper, preparation of, 312.
Ipswich, on the tides at, 445.
Iris, structure and mode of action of the, 439.
Iron-built ships, on the deviation of the compass in, 141.
Iron, cast, on the strength of pillars of, 227.
——, wrought, on the strength of pillars of, 228.
Ivory (J.) on such ellipsoids as are capable of having the resultant of the attraction of the mass upon a particle in the surface, and a centrifugal force caused by revolving about one of the axes, made perpendicular to the surface, 34.
—— on the theory of astronomical refractions, 59, 60.
—— on the conditions of equilibrium of an incompressible fluid, 157.
——, a Royal medal awarded to, 172.
——, biographical notice of, 406.

Jalap, resin of, 219.
Jeffreys (Julius) on the solubility of silica by steam, 232.
Jellicoe (C.) on the laws of mortality, 115.
Jesse (J.), description of an observatory constructed at Ardwick, 371.

Johnston (J. F. W.) on a new equiatomic compound of bicyanide with binoxide of mercury, 135.
—— on the constitution of the resins, 136, 162, 218, 241.
Johnstone (Dr. John), notice of the late, 15.
Jones (T. W.) on single vision with two eyes, 199.
——, memorandum addressed to the Royal Society by, 248.
—— on the blood-corpuscles, particularly with reference to opinions expressed and conclusions drawn by Dr. Barry, 431.
Joule (J. P.) on the production of heat by voltaic electricity, 280.
Julus terrestris, organs of reproduction of, 326.

Kane (Dr. R.), contributions to the chemical history of archil and litmus, 233, 337.
——, a Royal medal awarded to, 337.
—— on the chemical history of the compounds of palladium and platinum, 378, 379.
Kater (Capt. H.), description of an astronomical clock invented by, 221.
Kelly (Dr. W.) on low fogs and stationary clouds, 4, 33.
Kerguelen's Land, magnetic-term observations taken at, 293; hourly magnetic observations taken at, 293.
——, on the birds of, 298.
——, geological remarks on, 299, 305.
——, catalogue of geological specimens procured from, 305.
——, plants from, 305.
Kidney, on the structure and use of the Malpighian bodies of the, 375.
Kin, a Chinese stringed instrument, 297.
Knight (T. A.), biographical notice of, 92.
König (C.), his retirement from the office of foreign secretary, 10.
Kreil (Prof.), magnetic-term observations made at Prague, 280, 294, 329, 373, 380, 396, 439, 467.

Labdanum, resin of, 219.
LaCaille's arc of the meridian, on, 192.
Lake Victoria, 83.
Lambert (A. B.), notice of the late, 412.
Latham (Dr. J.), notice of the late, 12.
Lay (Mr.) on the scholar's lute among the Chinese, 297.
Lee (Dr. R.) on the nerves of the gravid uterus, 189.
—— on the nervous ganglia of the uterus, 321, 395.
—— on the anatomy and physiology of the decidua, 370.
Lefroy (Lieut. J. H.), meteorological observations made at St. Helena, 295.
—— on the influence of the moon on the atmospheric pressure, 395.
L'Huillier (S.), biographical notice of, 350.
Lempriere's meteorological register kept at Port Arthur, Van Diemen's Land, 200, 232, 329.
Levels, line of, across Northern Syria, 57.
Library of the Royal Society, catalogue of the, statement of the Council relative to Mr. Panizzi's claims, 9, 18, 171.
——, catalogue of the miscellaneous manuscripts, 253, 334.
——, catalogue of the miscellaneous literature, 334.
——, catalogue of the manuscript letters, 253.
——, report on the state of the, 333.
Liebig (Prof.), a Copley medal awarded to, 256.
Life contingencies, a new notation applicable to the doctrine of, 198.
Light, dispersion of, Rev. B. Powell's theory of, 47.
——, theory of dispersion of, as connected with polarization, 64, 210.
——, it action upon the colour of the river sponge, 72.
——, on the application of the chemical rays of, to purposes of pictorial representation, 131.
——, its action on nitrated paper, 132.
——, theoretical explanation of an apparent new polarity in, 239, 247.
——, polarized, phenomena of thin plates of solid and fluid substances exposed to, 302.
——, on the elliptic polarization of, 394, 436.
Lindsay (Maj.-Gen.), hourly observations of the barometer and thermometer at sea, 239.
Liquids, instrument for measuring the resistance of, 471.

Litmus, chemical history of, 233, 337.
Literature, miscellaneous, in the Library of the Royal Society, a catalogue made of the, 334.
Liverpool, tide observations at, 212.
Lloyd (Rev. H.), report on the cooperation of the Russian and German observers in a system of simultaneous magnetical observations, 197.
Lloyd (J. A.), approximate deductions made from about 50,000 observations at the P. Louis Observatory, Mauritius, 232.
Lobster, on the organ of hearing in the, 472.
Lochaber, on the parallel roads of, 127.
London, climate of, on a cycle of eighteen years in the mean annual height of the barometer in, 292.
——, on the prevailing winds, mean temperature and depth of rain in, 300.
Longitude, new method of determining, 52.
Lubbock (Sir John W.), notice of the late, 264.
Lubbock (Sir J. W.) on a theorem of Fermat, 290.
—— on an irregularity in the height of the barometer, 295.
Lungs, on the distribution of the air-passages and the formation of the air-cells of the, 381.
Lushington (E. L.), notice of the late, 177.
Lute, Chinese, on the, 297.
Lymphatic vessels, import and office of the, 448.

M'Cormick (R.) on the birds of Kerguelen's Land, 298.
——, geological remarks on Kerguelen's Land, 299.
MacCullagh (Prof.), a Copley medal awarded to, 419.
Macclesfield (Earl of), notice of the late, 418.
Macdonald (Dr.) on the markings of the eel-back dun variety of the horse, 163.
Machines, on the theory of, 318.
Macilwain (G.) on the relation between the respiratory organs of animals and the preservation of independent temperatures, 474.
Maclear (T.), account of the fall of a meteoric stone at the Cape of Good Hope, 134, 210.
——, observations made for the verification of the amplitude of La Caille's arc of the meridian, 192.
Madras, magnetic observations made at, 361, 371, 382.
——, magnetic and meteorological observations made at, 396.
Magnesia, salts of, its action on the blood, 285.
Magnetic and electric forces, relation of the, 77.
Magnetic dip and intensity, observations made at sea between Falmouth and the Falkland Islands, 212.
—— —— between England and Australia, 212.
—— declination, horizontal intensity and inclination, variation of the, observed at Milan, 282, 294, 298, 329, 362, 371, 435, 456, 462; at Brussels, 329.
—— inclination and intensity, lines of, in the Atlantic Ocean, 212.
—— needle, the importance of a more accurate determination of the variation of the, 21.
—— needle, on the variation of the, 437.
—— observations made in the West Indies, Coast of Brazils and North America, 4.
—— observations, simultaneous system of, 197.
—— observations made by H.M. ships Erebus and Terror, 221, 298.
—— observations made at the observatories at Singapore, at Madras and at Simla, 361, 362, 382, 383.
—— observatories, Baron Humboldt's proposal for the establishment of, 9, 170.
—— observatories in India, papers from the, 361.
Magnetic-term observations at Milan and Prague, 280, 293, 294, 311, 373, 396, 439, 467; at Kerguelen's land, 293.
—— taken at Hobart Town and Van Dieman's Land, 298.
—— taken at Singapore, at Madras and at Simla, 371.
Magnetical and meteorological observations, proceedings of the Royal Society relating to, 21, 332, 401.

Magnetical and meteorological observations, grant of £500 for the purchase of instruments, 21.

—— —— made at Madras, 371, 396; at Trevandrum, 396.

Magnetism, Prof. Gauss's researches on, 99.

——, theory of induced, 142.

——, terrestrial, Lieut-Col. Sabine's contributions to, 212, 221, 287, 369, 465, 468.

Malpighian bodies of the kidney, on the structure and use of the, 375.

Mansfield (Earl of), notice of the late, 264.

Mantell (G.) on the lower jaw of the Iguanodon, and on the remains of the Hylæosaurus and other Saurians of Tilgate Forest, 289, 290.

—— on the fossil remains of turtles in the chalk formation of the S. E. of England, 305.

Manuscript letters in the Library of the Royal Society, a catalogue made of the, 253.

Manuscripts in the Library of the Royal Society, a catalogue made of the, 253.

Marsh (Dr. Herbert, Bishop of Peterborough), biographical notice of, 174.

Marum (Dr. M. van), notice of the late, 99.

Mastic, resin of, 136.

Media, absorbent, of the analysis of the chemical rays of the spectrum by, 209.

——, of the exalting and depressing power exercised by certain, 209.

Medulla oblongata, the cerebellum considered as an appendage to the brain rather than to the, 473.

Medulla spinalis, on the decussation of fibres at the junction of, with the medulla oblongata, 71.

Megalosaurus, remains of, discovered in the strata of Tilgate Forest, 290.

Membrana granulosa, 74.

Mercury, on a new equi-atomic compound of bicyanide with binoxide of, 135.

——, photographic properties of, 398.

Meridian, LaCaille's arc of the, on the verification of the amplitude of, 192.

Metals, on their reduction from solutions of their salts by the voltaic circuit, 447.

Meteoric stone, account of the fall of a, at the Cape of Good Hope, 134, 210; chemical account of the, 134.

Meteorological instruments at the Royal Observatory, Greenwich, with which observations have been made, from Nov. 1840 to July 1841, 330.

—— journal kept at Allenheads, Northumberland, 221, 297, 371.

—— journal kept at the Falkland Islands, 330.

—— journal kept at Guernsey, 466.

—— observations on the mode in which they have been recorded in the Journal of the Royal Society, 2.

—— —— made at Alten in Finmarken, 195; remarks on, 229.

—— —— taken on board H.M.S. Erebus and Terror, 293, 303, 374, 380.

—— —— taken at Constantinople, 293.

—— —— made at St. Helena, 295.

—— —— made at Toronto, 295, 380.

—— —— made at Plymouth, 303.

—— —— taken at Madras, 362, 371, 382; at Simla, 362, 371, 383.

—— —— taken at the magnetic observatory, Cape of Good Hope, 374, 380.

—— —— taken at Van Diemen's Land, 374, 378, 380.

—— —— taken by the Niger Expedition, 380.

—— ——, taken at Georgetown, British Guiana, 467.

—— register kept at Port Arthur, 200, 232, 329.

—— register kept during a voyage from London to Calcutta and back to London, 329.

Microscopical examination of the teeth, 70.

—— examination of the texture of shells, 435.

—— examination of the texture of the iris in different animals, 439.

Milan, magnetic-term observations made at, 280, 311.

——, variation of the magnetic declination, horizontal intensity and inclination observed at, 282, 294, 298, 329, 362, 371, 435, 456, 462.

——, observations on magnetic direction and intensity made at, 295, 298.

Mixed plates, on the colours of, 33.

Modulus of a machine, 319; of a pulley, 320.

Mollusca, on the structure of the skeletons or hard parts of the, 435.
Monobasic salts, 102.
Moon, new method of determining the longitude by an absolute altitude of, 52.
——, on the influence of, on the atmospheric pressure, 395.
Morichini (Prof.), notice of the late, 18.
Mortality, on the laws of, 115.
Moseley (Rev. H.) on the geometrical forms of turbinated and discoid shells, 79.
—— on a calculating machine, 362.
—— on the theory of machines, 318.
Motion, rotatory, 66.
Mucus-globules, compared with corpuscles of the blood, 324.
Mudesous and mudesic acids, 239.
Munster (Earl of) notice of the late, 414.
Murchison (R. I.) description of Coggan's self-registering thermometer and barometer, 72.
Muscle, facts observed in the formation and structure of, 364.
——, voluntary, on the minute structure and movements of, 244, 301; the contraction of a muscle is the essential cause of its rupture, 301; there is no repellent force between the contractile elements of muscular fibre, 301.
Muscular tissue compared with corpuscles of the blood, 324.
Myriapoda, on the organs of reproduction and the development of the, 326.
——, on the circulation of the blood in the, 458.

Naples, barometrical observations taken at, 303.
Necker (L. A.), Apperçu sur une manière nouvelle d'envisager la théorie cristallographique dans le but d'établir les rapports de celle-ci avec la forme sphérique ou elliptique, des molécules, ainsi qu'avec l'effet des milieux sur la forme cristalline, 116.
Nerves, on the, 434.
——, physiological inferences derived from human and comparative anatomy respecting the origin of the, 472.
—— of the gravid uterus, on the, 189.
Nervous force, experimental relation of, to electric force, 112.
—— ganglia of the uterus, 321, 395.
—— system, on the, 218; the spinal nerves, 218; respiratory system of, 218; supply of blood to the nerves of the respiratory system, 218.
—— tissue, compared with corpuscles of the blood, 324.
Nervous and circulatory systems in articulated animals, 458.
Newbold (Capt.) on the Régar or black cotton soil of India, 53.
Newbold (T. J.) on the diamond mines of Golconda, 280.
Newport (G.) on the organs of reproduction, and on the development of the Myriapoda, 326.
—— on the structure and development of the nervous and circulatory systems in articulated animals, 458.
Newton's (Sir I.) solutions of the problem of the astronomical refractions, 59, 60.
——, an original portrait of, presented to the Royal Society by Prof. Vignolles, 296.
——, the autograph of the *Principia* in the possession of the Royal Society, 253, 335.
Niger Expedition, 253, 380, 401.
Nitrates, conversion of into chlorides, applied to the determination of equivalent numbers, 119.
Nitrogen, its influence on the growth of plants, 66, 148.
——, its evolution during the growth of plants, 70.
——, its influence in promoting vegetable decomposition, 148.
—— and carbon, compound bodies, 472.
Nobili's plate of colours, on, 195.
Northampton (Marquis of), address at Anniversary Meeting, Nov. 21, 1839, 168.
——, address at Anniversary Meeting, Nov. 30, 1840, 252.
——, letter to the Royal Society, read at the Anniversary Meeting, Nov. 30, 1841, 331.
——, address at Anniversary Meeting, Nov. 30, 1842, 400.
Norton (Capt. J.), on a percussion shell to explode at the bottom of the sea, 248.
Nutation and precession, phenomena

of, assuming the interior of the earth to be fluid and heterogeneous, 115, 129, 367.

Observatory at Ardwick, description of, 371.
Oceine, chemical examination of, 233, 337.
Ohm (Dr.), a Copley medal awarded to, for his researches into the laws of electric currents, 336.
Olbers (Dr.), notice of the late, 267.
Olibanum, resin of, 163.
Operculum, traces of progressive stages of its growth remain on it, 80; its spiral a logarithmic spiral, 80.
Opoponax, resin of, 219, 241.
Ornithorhynchus hystrix, on the form of the blood-particles of the, 232.
Otaheite, new determination of the magnetic elements at, 288.
Ovisac, on the origin and structure of the true, a vesicle common to all vertebrated animals, 73; in mammalia, &c., 74; cavity in which often found, 75; peculiar granules of the, 75; the fluid contained in the, 75; parasitic ovisacs, 75.
Ovum, the germinal vesicle and its contents are those parts which are first formed, 74; disappearance of ova and formation of others, 75; the ovum conveyed to the periphery of the Graafian vesicle, 75; the order of formation of the more permanent parts of the ovum and the Graafian vesicle in mammalia, 76; the mature and immature, 137; effects produced on, in the ovary by maceration, 137; in the ovary *post coitum*, 137; locality in which fecundated, 137; discharge of from the ovary, 137; the ovum after it has left the ovary, 138; its minute size no criterion of the degree of its development, 139; abortive ova, 139; may pass through at least one-and-twenty stages of development before it has attained the diameter of half a line, 139; some of the earliest appearances of the, 139; changes in the ovum consequent on fecundation, 222; no fixed relation between the degree of development of ova, and their size, locality or age, 224; the elements of the, compared with corpuscles of the blood, 324.
Ovum, mammiferous, discovery of the germinal spot in the, 279; spermatozoa observed in, 432.
Oxmantown (Lord), experiments on the reflecting telescope, 238.
Oxus, the river, discovery of the source of, 83.
Oxygen, the equivalent numbers of, 123.

Palgrave (Sir F.), account of the shooting stars of 1095 and 1243, 210.
Palladium, on the chemical history of the compounds of, 379.
——, on the reduction of, 447.
Panizzi's (Mr.) pamphlet, statement of the Council relative to, 18.
Paper, sensitive, on a new kind of, for photographic purposes, 134.
Parallel roads of Glen Roy, and of other parts of Lochaber in Scotland, on the, 127.
Parat (D.), nouveaux faits à ajouter à la théorie de la chaleur et à celle de l'évaporation, 473.
Parish (Sir W.), barometrical observations taken at Naples, 303.
Peña silver, experiments on, 119.
Pendulum, on the vibration of the, 78.
Penny (F.) on the application of the conversion of chlorates and nitrates into chlorides, and of chlorides into nitrates, to the determination of equivalent numbers, 119.
Pepys (W. H.) on the respiration of the leaves of plants, 466.
Percussion shell, to explode at the bottom of the sea, 248.
Phillips (Capt. C.), notice of the late, 262.
Phillips (R.) on the chemical equivalents of certain bodies, 123.
Phosphates, on the, 162.
Photogenic drawing, on the art of, 120.
Photography, preparation of photogenic paper, 124, 134.
——, account of the processes employed in photogenic drawing, 124.
——, on fixing the image, 125.
——, on the art of, 131.
——, influence of iodine in rendering argentine compounds, spread on paper, sensitive to light, 239.
——, improvements in, 312.
——, on fixing, taking copies and transfers, and the preparation of the paper, 206.

Photography, new processes in, 393, 397, 398.
——, photographic properties of mercury, 398.
Photometer, self-registering, 209.
Physical geology, 83, 115, 129, 367.
Physics, a new theory of, 325.
Physiology of vision, 76.
—— of cells, 222, 279.
—— of the decidua, 370.
—— of certain structures in the orbit, 311.
—— of the iris, 439.
Piccolomini (Comte), geographical position of the triangulations of the Californias and of the Mexican coasts of the Pacific, with heights of that part of the Cordilleras, 196.
Pigmentum nigrum, compared with corpuscles of the blood, 324.
Pigotite, on the constitution of, 239.
Pillars of cast-iron and other materials, on the strength of, 227.
Pinus abies, resin of, 163.
Planets, new method of computing the perturbations of, 435.
Plants, the influence of nitrogen on the growth of, 66, 148.
——, on the evolution of nitrogen during the growth of, 70.
——, on the formation of alkaline and earthy bodies in, 131.
—— from Kerguelen's land, 305.
——, on the ascent of the sap, and new method of preparing, for physiological investigations, 432.
——, on the descending fluids of, 449.
——, on the respiration of the leaves of, 466.
——, carbon and nitrogen made by, during their growth, 472.
Platina, on the reduction of, 447.
Platinum, on the compounds of, 380.
Plesiosaurus, remains of, found in Tilgate Forrest, 290.
Plymouth, on the laws of low water, and on the permanency of mean water at, 152.
——, tide observations at, 242.
——, hourly meteorological observations made at, 303.
Poiseuille's hæmadynamometer, 285.
Poisons, on the mode of operation of, 155.
Poisson (S. D.), biographical notice of, 269.
Polarimeter, an instrument for measuring the degrees of polarization, 307.
Polarization and double refraction of heat, Prof. Forbes's investigations of the, 104.
——, elliptic, of light, 394, 436.
——, on the theory of the dispersion of light as connected with, 64, 210.
Polarized light, phenomena of thin plates of solid and fluid substances when exposed to, 302.
Pollock (Sir F.), method of proving the three leading properties of the ellipse and the hyperbola from a well known property of the circle, 443.
Port Arthur, Van Diemen's Land, meteorological register kept at, 200, 232, 329.
——, register of tides at, 232.
Potassium, electro-chemical equivalents of, 232.
——, on the ferrosesquicyanuret of, 239.
——, iodide of, its applicability to the cure of chronic diseases, 473.
Powell (Rev. B.) researches towards establishing a theory of the dispersion of light, 47.
—— on the theory of the dispersion of light as connected with polarization, 64, 210.
—— on the theory of dark bands formed in the solar spectrum by transparent plates, 211.
—— on the elliptic polarization of light, 394.
—— on certain cases of elliptic polarization of light by reflection, 436.
Prague, magnetic-term observations made at, 280, 294, 329, 373, 380, 396, 439, 467.
Precession and nutation, phenomena of, assuming the interior of the earth to be fluid and heterogeneous, 115, 129, 367.
Prevost (P.), biographical notice of, 180.
Prince of Wales's Island, tidal observations at, 311.
Princep (J.), biographical notice of, 259.
Principia, Newton's, the manuscript of, in the possession of the Royal Society, 253, 335.
Prismatic colour, new, 208.
—— spectrum, extension of the visible, 207.

Prismatic spectrum, mathematical investigation of the phenomena of dark bands crossing the, 211.
Prony (M. de), biographical notice of the late, 178.
Prussia (King of), His Majesty's visit to the Royal Society, 370.
Pterodactylus, remains of, discovered in Tilgate Forrest, 290.
Pulley, modulus of the, 320.
Pus-globules, derived from corpuscles of the blood, 324.

Quetelet (Prof.) on the variation of the magnetic declination and horizontal intensity at Brussels, 329.

Rabbit, ova found in the Fallopian tube and uterus of the, 222.
Rain, average annual depth of, in London, 300.
——, depth of, in 1839, 203.
Rain-guage, a few remarks on the, 297.
——, the Royal Society's, on the position of, 3.
Rainey (G.) on the cause of the ascent and continued motion of the sap, 432.
—— on the descending fluids of plants, 449.
Rays of the solar spectrum, the chemical action of the, on preparations of silver, &c., 205; combined chemical action of rays of different degrees of refrangibility, 208; the whitening power of several under the influence of hydriodic salts, 208; analysis of the chemical by absorbent media, 209.
Reade (Rev. J. B.) on a new theory of earthy bases of vegetable tissues, 52.
—— on the construction and use of single achromatic eye-pieces, 195.
Receipts and Expenditure of the Royal Society, in 1836–37, 29; in 1837–38, 106; in 1838–39, 185; in 1839–40, 272; in 1840–41, 355; in 1841–42, 423.
Red rays, chemical action traced much beyond the extreme, 208.
Redhouse (J. W.), results of meteorological observations at Constantinople, 293.
Rees (Dr. G. O.) on the chemical analysis of the contents of the thoracic duct, 373.
Refractions, astronomical, on the theory of, 59, 60; Cassini's theory, 60; problem of, Newton's solutions, 59, 60; comparison of tables of, 63.
Refractive indices, comparison of observed, with the results of theory, 47.
Régar soil of India, on the, 53.
Resins, on the constitution of, 136, 162, 218, 241.
Respiration, theory of, experiments on the blood in connexion with, 78.
—— of the leaves of plants, on the, 466.
Respiratory organs of animals and the preservation of independent temperatures, the relation which exists between, 474.
—— system of nerves, on the, 218.
Rete mucosum, 165.
Retin-asphalt, resin of, 219.
Rickman (Mr.), notice of the late, 261.
Riddell (Lieut. E. J. B.), meteorological observations made at Toronto, 295.
Rigaud (Prof.), biographical notice of, 175.
Rigg (R.) on the influence of nitrogen on the growth of plants, 66, 148.
—— on the evolution of nitrogen during the growth of plants, 70.
—— on the formation of alkaline and earthy bodies with reference to their presence in plants, 131.
—— on the influence of nitrogen in promoting vegetable decomposition, 148.
—— on the chemical constitution of bodies which undergo the vinous fermentation, 149, 165.
—— on the formation of alkaline and earthy bodies by chemical action, 165.
——, experiments showing that carbon and nitrogen are compound bodies, 472.
Ritchie (Wm., LL.D.), notice of the late, 14.
Robertson (J.), geological specimens procured from Kerguelen's Land, 305.
——, description of plants from Kerguelen's Land, 305.
——, catalogue of birds collected on board H.M.S. Terror, between the Cape of Good Hope and Van Diemen's Land, 305.

Roccella tinctoria, (Archil-weed) chemical examination of, 233, 337.
Roccelline, 233.
Rokewode (J. G.), notice of the late, 418.
Ross (Capt. J. C.), magnetic observations, 220.
——, magnetic-term observations taken on board H.M.S. Erebus and Terror, 298.
——, magnetic-term observations taken at Kerguelen's Land, 293.
——, magnetic-term observations made at Van Diemen's Land, 298.
——, hourly magnetic observations taken at Kerguelen's Land, 293.
——, hourly magnetic observations taken at Van Diemen's Land, 298.
—— meteorological observations taken on board H.M.S. Erebus and Terror, 293, 303, 374, 380.
—— notices of the Aurora Australis in Mar. 1841, 395.
Rotatory motion, on, 66.
Royal Medals, the grant of the, continued by Her Majesty Queen Victoria, 69, 87.
——, alterations in the laws for the distribution of, 88.
——, awarded to the Rev. William Whewell, 6, 24; to H. F. Talbot, Esq., 101; to Prof. Thomas Graham, 102; to Sir J. F. W. Herschel, 255; to Prof. Wheatstone, 255; to Robert Kane, M.D., 337; to Eaton Hodgkinson, Esq., 338; to W. Bowman, Esq., 422; to Prof. Daniell, 422.
Royal Observatory, Greenwich, on the meteorological instruments at, 330.
Rumford Medal, awarded to Professor Forbes, 104; to Mr. Fox Talbot, 422.
Rutherford (W.), computation of the ratio of the diameter of a circle to its circumference to 208 places of decimals, 302.

Sabine (Joseph), notice of the late, 15.
Sabine (Lieut.-Col.) on magnetical observations in Germany, Norway, and Russia, 197.
——, contributions to terrestrial magnetism, 212, 221, 287, 369, 465, 468.
——, remarks on the meteorological observations made at Alten, 229.
Sagapenum, resin of, 241.
Saint Helena, meteorological observations made at, 295.
Salts, Prof. Graham's inquiries respecting the constitution of, 102.
Salts of magnesia, zinc, copper, lime, strontia, baryta, lead, silver, soda, ammonia and potass, their action on the blood, 285.
Sandarach, resin of, 163.
Sap, on the cause of the ascent and continued motion of, 432.
—— on the descent of, in plants, 449.
Sarcolemna, or tunic of the primitive fasciculus of voluntary muscle, 245.
Saunders (G.), notice of the late, 178.
Saurians, remains of, discovered in the strata of Tilgate Forest, 290.
Savart (F.), biographical notice of, 352.
Scammony, resin of, 218.
Schœnbein (Prof.) on the odour accompanying electricity, 226.
Scilly Islands, shock of an earthquake in the island of St. Mary's, 122.
Sea's surface, laws of the rise and fall of, during each tide, 242.
Secondary compounds, electrolysis of, 153, 231.
Seppings (Sir R.), notice of the late, 263.
Shell, percussion, to explode at the bottom of the sea, 248.
Shells, microscopic examination of the texture of, 435.
——, on the combinations of the component elements of, 467.
——, turbinated and discoid, geometrical forms of, 79.
Shell-lac, specific inductive capacity of, 40, 100.
Ship's compass, on the deviation of, in iron-built ships, 141.
——, iron-built, experiments for discovering a correction for the deviation of the compass in, 141.
Shooting stars, account of those of 1095 and 1243, 210.
Silica, on its solubility by steam, 232.
Silver, Peña, experiments on, 119.
——, the equivalent number of, 123.
——, on the reduction of, 447.
Simla, magnetic and meteorological observations made at, 362, 371, 383.
Singapore, tidal observations at, 311.
——, magnetic-term observations made at the observatory at, 371.
——, graphic representations of the term-day observations, 371.

Singapore, magnetic observations at, 382.
Skin, on the special function of the, 445.
——, a newly discovered parasitic animalcule of the, 455.
Smee (A.) on the ferrosesquicyanuret of potassium, 239.
—— on the structure of normal and adventitious bone, 198.
—— on the reduction of metals from solutions of their salts by the voltaic circuit, 447.
Smith (Sir W. Sydney), notice of the late, 264.
Smyth (Capt.), his retirement from the office of foreign secretary, 172.
Soane (Sir John), notice of the late, 16.
Sodium, electro-chemical equivalents of, 232.
Solar spectrum, visibility of certain rays beyond the ordinary red rays of the, 146.
——, chemical action of the rays of the, on preparations of silver, &c., 205; chemical analysis of the, 207; of the whitening power of the several rays under the influence of hydriodic salts, 208; analysis of the chemical rays by absorbent media, 209; on the distribution of the calorific rays in the, 209.
——, theory of the dark bands formed in, 211.
——, action of the rays of the, on vegetable colours, 208, 393, 397.
Somerville (Mrs.), a bust of, by Chantrey, in the possession of the Royal Society, 402.
Southampton, on the tides at, 445.
Spaniolitmine, 234.
Spark, electric, 51.
Spectrum, solar, on the visibility of rays beyond the ordinary red rays of, 146.
——, calorific, account of a process for rendering it visible, 209.
——, prismatic, extension of the visible, 207; phenomena of dark bands crossing the, 211.
Speculum of a reflecting telescope, on the, 238.
Spermatozoa observed within the mammiferous ovum, 432.
Spiral, logarithmic, the form affected by the opercula of turbinated shells and by these shells, 80.
Spleen, on the structure and functions of the, 164.
——, on the general and minute structure of the, 456.
Sponge (*Spongilla fluviatilis*), the action of light upon the colour of, 72.
Springs, intermitting, on, 43.
Stark (Dr. J.) on the nerves, 434.
—— on the supposed development of the animal tissues from cells, 468.
Steam, solubility of silica by, 232.
Steam-wave, on the, 372.
Steel, strength of pillars of, 228.
Steneosaurus, remains of, discovered in Tilgate Forest, 290.
Stereoscope, an instrument for the investigation of the phenomena of binocular vision, 77.
Strength of pillars of cast-iron, &c., 227.
Sturm (M.), a Copley medal awarded to, 256.
Sugar, not constituted of carbon and water only, 150.
Sulivan (Lieut. B. J.), observations of the dip and intensity, made at sea between Falmouth and the Falkland Islands, 212.
Sulphur, inductive capacity of, 41, 100.
Sulphuric acid, on its relative attractions for water, 81.
——, on the manufacture of, 81.
Sun's atmosphere, indications of an absorbent action in the, 208.
Suppuration, on, 67.
Sussex (Duke of), his Royal Highness's address read at Anniversary Meeting, Nov. 30, 1837, 5.
——, address on the occasion of Her Majesty inscribing her name in the Charter Book as Patroness of the Royal Society, 6, 69, 88.
——, address read at Anniversary Meeting, Nov. 30, 1838, on his retirement from the office of President, 86.
——, the cordial thanks of the Society presented to, 99.
——, portrait of, in the possession of the Royal Society.
——, address of condolence to Her Majesty on the demise of, 254.
Swan (J.), physiological inferences derived from human and comparative anatomy respecting the origin of the nerves, &c. 472.
Sykes (Lt.-Col.), remarks on the me-

teorological observations made at Alten, 229.
Syria, Northern, account of a line of levels across, 57.

Tahiti, tide observations at, 440.
——, general remarks on the tides at, 440.
Talbot (H. F.), the Royal medal awarded to, for his researches in the integral calculus, 101.
—— on the art of photogenic drawing, 120.
——, account of the processes employed in photogenic drawing, 124.
—— on a new kind of sensitive paper, 134.
—— on improvements in photography, 312.
——, the Rumford medal, awarded to, 422.
Tate (W.) on factorial expressions and the summation of algebraic series, 456.
Taylor's theorem, new demonstration of, 456.
Teeth, on the structure of the, 70.
Telerythrine, chemical examination of, 233.
Telescope, reflecting, experiments on the, 238; method of forming a large speculum of several castings, 239.
——, construction and use of single achromatic eye-pieces for, 195.
Temperature, diurnal, of the earth's surface, 377, 444.
Terrestrial magnetism, 212, 221, 287, 369, 465, 468.
Tetanus, on the human muscular fibre affected by, 301.
Thames, on the rise and fall of the tide in the river, 330.
Thermo-electricity, on the phenomena of, 215.
Thermometer, hourly observations at sea of the, 239.
——, the Royal Society's, on the position of, 3.
—— and Barometer, Coggan's, 72.
Thermometrical observations at Cape Palmas, 331.
Thin plates, phenomena of, of solid and fluid substances exposed to polarized light, 302.
Thomas (S. H.), meteorological observations at Alten in Finmarken, 195, 229.
Thomson (W. T.), account of a line of levels across Northern Syria, from the Mediterranean sea to the river Euphrates, 57.
Thoracic duct, chemical analysis of the contents of, 373.
Tiarks (Dr.), notice of the late, 12.
Tide-guage, new, 53.
Tide observations, method of discussing those of Bristol, 73, 243.
—— at Petropaulofsk 217; at Sitkhœ, 217; at Prince of Wales's Island, 311; at Singapore, 311; at Tahiti, 440.
—— phenomenon, questions respecting, 73.
Tides, deduction of the laws of, from short observations, 72.
——, low water, on the laws of, at Plymouth, 152.
—— at Southampton and at Ipswich, 445.
—— in the Thames, on the rise and fall of, 330.
——, register of, at Coringa, 330.
——, researches on, 72, 152, 217, 242.
——, simultaneous observations, 8.
——, the high-water mark at Waterloo Bridge and at London Bridge, 3, 22.
Timber, strength of pillars of, 228.
Tin, on the reduction of, 447.
Tomes (John) on the structure of the teeth, 70.
Toronto, meteorological observations made at, 295, 380.
Torpedo, observations on the, 291.
Toynbee (J.) on the non-vascularity and peculiar uniform mode of organization and nutrition of certain animal tissues, viz. articular cartilage, and the cartilage of different classes of fibro-cartilage; the cornea, the crystalline lens, and the vitreous humour; and the epidermoid appendages, 306, 308.
Transverse force of electric currents, 56.
Trevandrum, magnetic and meteorological observations at, 396.
Tribasic salts, 102.
Tunica granulosa, a granulous tunic of mammalia not hitherto described, 75.
Tunica vaginalis oculi, on the, 311.
Turner (Edw., M.D.), notice of the late, 13.
Turtles, fossil remains of, in the chalk

formation of the south-east of England, 305.

Uterus, on the nerves of the gravid, 189.
——, on the nervous ganglia of the, 321, 395.
Utting (A.), hourly meteorological observations made at Plymouth, 303.
——, barometrical observations made at Yarmouth, 369.

Vacuum, relations of a, to electrical phenomena, 55.
Van Diemen's Land, magnetic and meteorological observations at, 298, 374, 378, 380.
Vegetable colours, effect of the spectrum on, 208, 393.
—— decomposition, influence of nitrogen in promoting, 148.
—— impregnation, Mr. Brown's discoveries in, 173.
—— tissues, on a new theory of earthy bases of, 52.
Vegetables, on the ascent of the sap in, 432.
Vibration of the pendulum, 78.
Victoria, Queen, the address on the occasion of receiving Her Majesty's signature as Patroness of the Royal Society, 69.
——, the address of congratulation to Her Majesty on the occasion of her marriage, 203.
——, address of congratulation to Her Majesty on the occasion of the traitorous attack made upon her life, 237.
——, address of congratulation to Her Majesty on the birth of the Princess Royal, 281.
——, address of congratulation to Her Majesty on the birth of the Heir to the Throne, 332.
——, address of congratulation on the providential escape of Her Majesty from the attack of an assassin, 391.
——, address of condolence to Her Majesty on the occasion of the demise of H.R.H. the Duke of Sussex, 463.
Vignolles (Prof.), an original portrait of Sir Isaac Newton presented to the Royal Society by, 296, 333.
Vigors (N. A.), notice of the late, 261.
Viola tricolor, action of light on a solution of, spread on paper, 393.
Vision, binocular, on some remarkable phenomena of, 76.
——, single, with two eyes, on, 199.
Vitreous humour, a non-vascular animal tissue, 310.
Vivian (Lord), notice of the late, 415.
Voltaic battery, Prof. Daniell's constant battery a new form of the, 23.
——, Prof. Daniell's dissected battery, 24.
—— battery, constant, account of the effects of a large, 147.
—— battery, on the possibility of obtaining a spark before the circuit is completed, 193.
—— battery, gas, on the, 463.
—— circuit, reduction of metals from solutions of their salts by the, 447.
—— circuit, new instruments and processes for determining the constants of a, 469.
—— combinations, on, 23, 43, 147, 383, 384.
—— electricity, contact theory of, 200, 215; chemical theory of, 201; chemical and contact theories compared, 202; on the production of heat by, 280.
—— pile, source of power in the, 200, 213.

Walton (Rev. W.), meteorological journal kept at Allenheads, with remarks on the rain-guage, 221, 297, 371.
Water, on the relative attractions of sulphuric acid for, 81.
Watson (H. H.) on the relative attractions of sulphuric acid for water, 81.
Weddle (T.) on a new method of solving numerical equations, 300.
Wellstead (Lieut.), notice of the late, 419.
West Indies, magnetical observations made in, 4.
Wharton (W. L.) on intermitting springs, 43.
Wheatstone (Prof.) on some remarkable and hitherto unobserved phenomena of binocular vision, 76.
——, description of the electro-magnetic clock, 249.
——, a Royal medal awarded to, 255.
——, account of new instruments and

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processes for determining the constants of a voltaic circuit, 469.
Whewell (Rev. W.), a Royal medal adjudged to, 6, 24.
——, researches on the tides, 67, 72, 152, 153, 217, 242.
—— on the deduction of the laws of the tides, from short series of observations, 72.
—— on the laws of low water at Plymouth, and on the permanency of mean water, 152.
—— on tide observations made in the Indian seas, 153, 217.
—— on the laws of the rise and fall of the sea's surface during each tide, 242.
Wickham (Capt.), observations of the dip and intensity, made between England and Australia, 212.
Wilkins (Prof.), notice of the late, 176.
William IV., notice of his late Majesty, 5.
Williams (J. L.), notice of the late, 95.
Willis (Dr. R.) on the special function of the skin, 445.
—— on the import and office of the lymphatic vessels, 448.
Wilmot (F. E.), meteorological observations taken at the Cape of Good Hope, 374, 380.
Wilson (E.) on the structure and development of a newly discovered parasitic animalcule of the human skin, 455.
Wind table, from observations taken at Gibraltar, 432.
Wood (Lieut.), discovery of the source of the Oxus, 83.
Wordley (Rev. G.), notice of a shock of an earthquake in one of the Scilly Islands, 122.
Work of a machine, 318.
Wyattville (Sir J.), notice of the late, 262.

Yarmouth, barometrical observations made at, 369.
Yelk, the proper membrane of the, in mammals, 76.
Yelloly (Dr.), biographical notice of, 415.
Yorke (Lt.-Col. P.) on electro-chemical equivalents, 232.
——, barometrical observations showing the effect of the direction of the wind on the difference between distant barometers, 386.
Young (J. R.) on the curvature of surfaces, 112.
Younghusband (Lieut. C. W.), meteorological observations taken at Toronto, 380.
Xanthorrhœa hastilis, acaroid resin from, 163.

END OF THE FOURTH VOLUME.

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